

CRANFIELD UNIVERSITY

Paul Anthony Stevens

AN INVESTIGATION INTO THE CATEGORISATION OF
ORGANISATIONS TO UNDERSTAND THE POTENTIAL
BARRIERS AND MOTIVATIONS TO CERTIFICATION OF AN
ENVIRONMENTAL MANAGEMENT SYSTEM: BS EN ISO
14001:2004

SCHOOL OF APPLIED SCIENCES
PhD/MPhil

PhD
Academic Year: 2009 - 2012

Supervisor: Dr. William Batty and Dr. Gillian Drew
11.2012

CRANFIELD UNIVERSITY

SCHOOL OF APPLIED SCIENCES
PhD/MPhil

PhD

Academic Year 2009 – 2012

Paul Anthony Stevens

AN INVESTIGATION INTO THE CATEGORISATION OF
ORGANISATIONS TO UNDERSTAND THE POTENTIAL
BARRIERS AND MOTIVATIONS TO CERTIFICATION OF AN
ENVIRONMENTAL MANAGEMENT SYSTEM: BS EN ISO
14001:2004

Supervisor: Dr. William Batty and Dr. Gillian Drew
11.2012

This thesis is submitted in partial fulfilment of the requirements for
the degree of PhD

© Cranfield University 2012. All rights reserved. No part of this
publication may be reproduced without the written permission of the
copyright owner.

ABSTRACT

An investigation has been undertaken to ascertain the extent of the existing knowledge base regarding publically voluntary instruments capable of supporting organisations in developing improvements in environmental management. The multifaceted nature of the organisations seeking certification mean a generic approach to implementation is unlikely to deliver the desired after results or a resource efficient approach. Furthermore, the diversity of opinions recorded in the literature is often based on anecdotal evidence and small scale research projects. There is a lack of verifiable knowledge and understanding of the difficulties and barriers experienced by organisations attempting to secure certification for existing voluntary instruments for environmental management such as ISO 14001.

The aim of the Research:

ISO 14001 is the fastest growing of the ISO Standards related to Environmental Management Systems; however existing research has been small scale and anecdotal. This research aims to confirm or dispute the present discussions and assumptions surrounding the motivations and barriers to certification to ISO 14001. Through deductive reasoning this research will provide a comprehensive investigation into the barriers and motivations experienced in its implementation. It is proposed that more comprehensive opportunities for organisational categorisation may also be defined.

The focus of the research has been to consider:

- The potential for integration of these voluntary instruments.
- The effects of the detailed requirements of the standard ISO 14001 on its certification and implementation processes.
- The perceived and actual barriers to implementation
- The opportunities to categorise participating organisations accordingly.

An analysis of instruments available to support organisations in improving their environmental management has been undertaken. A complex and diverse array of instruments have been reviewed beyond the most regularly discussed ISO

14001. Considerable overlaps were identified in the requirements of the various instruments, suggesting opportunities for integration and resource efficiencies in implementation which have not previously been investigated.

A detailed review of the certification processes of over 850 organisations certified to ISO 14001 was undertaken. This highlighted patterns in the barriers to implementation that have not previously been observed and which, in some cases, contradict existing literature.

It has been shown that existing categorisation of originations was often only on the basis of whether an organisation was an SME or NON SME. However, it was proposed that this method lacked discrimination, with SME encompassing 99.8% of private sector businesses in the UK. This research has elicited significant motivations and barriers to EMS implementation and used these to provide an objective basis to categorise organisations.

The outcome of this research has been:

- A novel assessment of integration opportunities for 13 instruments.
- An objective review of the certification and implementation processes for ISO 14001.
- The development of taxonomies that encompasses multiple criteria that exhibit significant variability that could provide a method of classification for organisations.

Keywords:

Environmental Management Systems, Classification, Classes, ISO 1400, Integration

ACKNOWLEDGEMENTS

To Liz and Noel

Noel for starting me on this journey and

Mum for giving me the motivation to see it through

I could not have completed this thesis without help and contributions from many people at Cranfield University, many who I now feel fortunate enough to call friends.

I would like to especially thank Phil Longhurst for the excellent advice provided and for supporting this project from start to finish. I would also like to make a special mention to Gill Drew for providing me with this opportunity and much appreciated supervision. Finally, I would like to say a huge thank you to Bill Batty for postponing retirement and, I'm sure, many relaxing evenings to read and re-read this thesis with a patience I'm in awe of. Without your guidance, supervision and coffee I don't think I could have achieved this.

I would like to say a thank you to all the other researchers who's help has often been as simple as being there for a good chat and a cup of tea, but none the less important for it. A special thank you goes to Pip, for helping me keep it all in perspective and spelling everything.

Personally, I would like to thank all my family and friends, especially my dad and brother whose belief in me made all the difference.

Lastly, thank you Soph, not just for putting up with me and listening to my ramblings over the last few months but all your help and support.

TABLE OF CONTENTS

ABSTRACT	i
ACKNOWLEDGEMENTS.....	iii
LIST OF FIGURES.....	viii
LIST OF TABLES	xiii
LIST OF TABLES FOR APPENDIX D.....	xiv
LIST OF ABBREVIATIONS	xv
1 Introduction to Thesis Aim and Structure.....	17
1.1 Introduction	17
1.2 Research Aim	17
1.3 Research Process.....	18
2 Environmental Management Systems and the Motivations and Barriers to their Implementation.....	19
2.1 Introduction	19
2.2 Organisational Size.....	20
2.3 Environmental Management within Organisations.....	23
2.4 Motivations and Barriers to the Implementation of Instruments That Support environmental management in SME	27
2.5 Conclusion/Future Objectives	33
References	35
3 Potential Opportunities for the Integration of Voluntary Systems Management Standards	39
3.1 Introduction	39
3.2 The Standards	44
3.3 Investigation of the opportunities for integration	47
3.3.1 General Observations Regarding Standards Requirements	47
3.3.2 Standards' Requirement Regarding "Planning"	49
3.3.3 Standards' Requirements Regarding "Doing".....	51
3.3.4 Standards' Requirements Regarding "Checking"	55
3.3.5 Standards' Requirements Regarding "Acting"	57
3.4 Conclusion	58
3.5 Discussion	58
References	60
4 Patterns in Nonconformities Raised During the ISO 14001 Audit Process....	63
4.1 Introduction	63
4.2 Developing an Understanding of nonconformities Occurring During the ISO 14001 External Audit Process.....	64
4.3 Method.....	66
4.4 Results.....	68
4.5 Conclusion	75
4.6 Discussion	76

References	79
5 A Critical Review of Classification of Organisations in Relation to the Voluntary Implementation of Environmental Management Systems	83
5.1 Introduction	83
5.2 Evolution of Environmental Management Systems.....	83
5.3 Barriers to Environmental Management Systems	84
5.4 Existing Methods of Organisational Classification	86
5.5 Classification through Organisational Size.....	87
5.6 Classification Based on Stages of Integration, Development and Evolution	89
5.7 Classification Through the use of Cladistics	91
5.8 Classification Related to the Concepts of Quality Management	94
5.9 Future Opportunities for Classification.....	95
5.10 Discussion	97
5.11 Conclusions	100
References	102
6 Method for Primary Research into ISO 14001 and the Analysis and Representation of Data Collected.....	107
6.1 Introduction	107
6.1.1 Method for Primary Research into ISO 14001.....	108
6.1.2 Questionnaire Bias.....	110
6.2 Analysis and Representation of Data Collected	111
6.2.1 Factor Analysis.....	111
6.3 Basic graphical representation.....	115
6.3.1 Qualitative responses.....	116
6.4 Method Objectives	117
References	118
7 Results	119
7.1 Introduction	119
7.2 Synopsis of Results	119
7.2.1 Second Stage of the Factor Analysis Results	123
7.2.2 Combining the Results from Stage1 and 2.....	127
7.3 Graphical Representation of Questionnaire Results	133
7.4 Conclusion	146
References	147
8 Conclusion.....	149
8.1 Chapter 2 Literature review.....	149
8.2 Chapter 3 Investigation into voluntary instruments	149
8.3 Chapter 4 Analysis of ISO 14001 Non conformities	150
8.4 Chapter 5 Classification of organisations.....	151
8.5 Chapter 7 Questionnaire Results.....	152
8.6 Conclusion	156

9 Discussion	157
9.1 Introduction	157
9.2 Objective 1	157
9.3 Objective 2	158
9.4 Objective 3	161
9.5 Limitations of the research and Proposals for Improvement	162
9.6 The Value and Benefits of this Research Project.....	164
9.6.1 Specific recommendations	164
References	166
APPENDICES	169
Appendix A Article Published in the Journal of Environmental Management.....	169
Appendix B SGS Client Questionnaire.....	179
Appendix C Results of Statistical Analysis.....	189
Appendix D Graphical Representation of Questionnaire Results.....	207

LIST OF FIGURES

Figure 1: Thesis Research Process	18
Figure 2: Organisation Category by size (European Union, 2005)	21
Figure 3: The Composition of UK Organisations (BIS, 2008)	22
Figure 4 - Map of instruments that Offer Support for Improvements in Environmental Management	26
Figure 5: Question 9: Our organisation integrates its policy and procedures for multiple standards (Percentage taken from 88 respondents).	43
Figure 6: Percentage of Occurrence of Nonconformities for ISO 14001 clauses for all organisations	70
Figure 7: Percentage of Occurrence of ISO 14001 Nonconformities Categorised by Organisational Size	71
Figure 8: Percentage of Occurrence of ISO 14001 Nonconformities Categorised by Organisational Size for Specific Clauses.....	72
Figure 9: Average Number of Nonconformities occurring in relation to organisation size	73
Figure 10: Percentage of Occurrence of Nonconformities Categorised by Organisational Sector.....	75
Figure 11: The Seven S Model and the Correlation with Discussed Categories	97
Figure 12: Example of Likert-type 5 scale question.....	111
Figure 13: Scatter Plot of Factors 3 and 4 labelled by Question 20e.....	113
Figure 14: Factor 1 and 2 Groupings of Questions where the Principle Component was Greater than 0.7	114
Figure 15: Question 9: Responses to the statement: Our organisation integrates its policy and procedures for multiple standards.	115
Figure 16: Question 3: The percentage of people responding “Agree or strongly agree” to the question: To what extent did each of the following drivers influence your decision to implement ISO 14001?	116
Figure 17: Scatter Plot of Factors 1 and 2 Classified by Organisational Size.	120
Figure 18: Scatter Plot of Factors 3 and 4 Classified by Organisational Size.	121
Figure 19: Scatter Plot of Factors 1 and 2 Labelled by Question 20a	122
Figure 20: Scatter Plot of Factors 3 and 4 Labelled by Question 20e	123

Figure 21: Factor 1 and 2 Groupings of Questions where the Principal Component was Greater than 0.7	126
Figure 22: Factor 3 and 4 Groupings of Questions where the Principal Component was Greater than 0.7	127
Figure 23: Question 3: The percentage of people responding "Agree or strongly agree" to the question: To what extent did each of the following drivers influence your decision to implement ISO 14001?	133
Figure 24: Question 4: The percentage of people responding "Agree or strongly agree " to the question: To what extent do the following aspects motivate you to maintain your certification to ISO 14001?.....	134
Figure 25: Question 7: The percentage of people responding "Agree or strongly agree" to: the question: Which aspects of your EMS do you believe are most likely to cause nonconformities?.....	135
Figure 26: Question 17: The percentage of people responding "Agree or strongly agree" to the question: The aspects of your EMS you believe actually caused the most problems	137
Figure 27: Question 6: The percentage of people responding "Agree or strongly agree" to the question: The implementation of the Environmental Management System (EMS) has been of significant value in terms of: ..	138
Figure 28: Question 35: The percentage of people responding "Agree" to the question: For each sector please state the level of commitment you believe was achieved in relation to your EMS	139
Figure 29: Question 9: Our organisation integrates its policy and procedures for multiple standards	140
Figure 30: Question 14: Responses to the statement: Our EMS is integrated with existing processes and procedures e.g. setting of objective and/or purchasing.....	141
Figure 31: Question 5: Since the initial decision to implement ISO 14001 was made it has become more fundamental to the organisations business development?.....	142
Figure 32: Question 6: The percentage of people responding "Agree and strongly" to the question: The implementation of the EMS has been of significant value in terms of:	143
Figure 33: Question 19: The percentage of people responding "Agree or strongly agree" to the question: ISO 14001 was financially beneficial in terms of	145

LIST OF FIGURES FOR APPENDIX C

Figure C 1 : Factor 1 and 2 Groupings of Questions where the Principle Component was Greater than 0.7	190
Figure C 2: Factor 3 and 4 Groupings of Questions where the Principle Component was Greater than 0.7	191
Figure C 3: Scatter Plot of Factors 1 and 2 Labelled by Organisational Size .	192
Figure C 4: Scatter Plot of Factors 3 and 4 Labelled by Organisational Size .	192
Figure C 5: Scatter Plot of Factors 1 and 2 Labelled by Organisational Type	194
Figure C 6: Scatter Plot of Factors 3 and 4 Labelled by Organisational Type	194
Figure C 7: Scatter Plot of Factors 1 and 2 Labelled by Stage of Certification	196
Figure C 8: Scatter Plot of Factors 3 and 4 Labelled by Stage of Classification	196
Figure C 9: Scatter Plot of Factors 1 and 2 Labelled by Question 20a.....	198
Figure C 10: Scatter Plot of Factors 3 and 4 Labelled by Question 20a.....	199
Figure C 11: Probability Plot of Data for Question 20a.....	201
Figure C 12: Predicted vs Residual Values for Question.....	201
Figure C 13: Effective Hypothesis Decomposition Representing Scoring of Question 20a.....	202
Figure C 14: Scatter Plot of Factors 1 and 2 Labelled by Question 20e.....	203
Figure C 15: Scatter Plot of Factors 3 and 4 Labelled by Question 20e.....	204

LIST OF FIGURES FOR APPENDIX D

Figure D 2 Question 2: The goals of the organisation are clearly communicated. to all employees?.....	203
Figure D 3: Question 3: The percentage of people responding "Agree" to the question: To what extent did each of the following drivers influence your decision to implement ISO 14001?	208
Figure D 4: Question 4: The percentage of people responding "Agree" to the question: To what extent do the following aspects motivate you to maintain your certification to ISO 14001?	209
Figure D 5: Question 5: Since the initial decision to implement ISO 14001 was made it has become more fundamental to the organisations business development?.....	210

Figure D 6: Question 6: The percentage of people responding “Agree” to the question: The implementation of the Environmental Management System (EMS) has been of significant value in terms of:	211
Figure D 7: Question 7: The percentage of people responding “Agree” to: the question: Which aspects of your EMS do you believe are most likely to cause nonconformities?	212
Figure D 9: Question 9: Our organisation integrates its policy and procedures for multiple standards.....	213
Figure D 10: Question 10: Sufficient resources where allocated to the implementation of ISO 14001.....	215
Figure D 11: Question 11: Our organisation maintains ISO 14001 as part of a wider Corporate Social Responsibility strategy	216
Figure D 12: Question 12: The percentage of people responding “Agree” to: the question: External consultancy was most beneficial when.....	217
Figure D 13: Question 13: The organisation communicates the outcomes of the EMS internally via (Please select those that apply).....	218
Figure D 14: Question 14: Our EMS is integrated with existing processes and procedures e.g. setting of objective and/or purchasing	220
Figure D 15: Question 15: If your organisation undertakes any of the following, how often?.....	221
Figure D 16: Question 16: Employees can access information relevant to ISO 14001 via:.....	222
Figure D 17: Question 17: The percentage of people responding “Agree” to the question: The aspects of your EMS you believe actually caused the most problems	223
Figure D 18: Question 18: The budgeted cost of ISO 14001 implementation was sufficient to achieve certification.....	224
Figure D 19: Question 19: The percentage of people responding “Agree” to the question: ISO 14001 was financially beneficial in terms of:.....	224
Figure D 20: Question 20: Do you feel the performance of your EMS has improved other aspects of performance in relation to:	225
Figure D 21: Question 21: Initially our organisation was lacking the required skills to implement ISO 14001	225
Figure D 22: Questions 22 to 27: Where were experience and available skill sets beneficial during particular stages of ISO 14001 certification? (Please select as many or as few options as you wish):	227
Figure D 29: Question 29: Relevant training and information has been provided to all employees in the form of:	231

Figure D 30: Question 30: Our organisation actively encourages open discussions and communication within and across different departments	232
Figure D 31: Question 31: When the EMS was implemented all employees were consulted.....	234
Figure D 32: Question 32: Communication is seen by the organisation as fundamental to the success of the EMS.....	235
Figure D 33: Question 33: Our organisation partakes and actively encourages employees to participate in charitable, environmental and/or social activities	236
Figure D 34: Questions 34: Our organisation chose to externally publicise the results of its environmental achievements.....	237
Figure D 35: Question 35: The percentage of people responding “Agree” to the question: For each sector please state the level of commitment you believe was achieved in relation to your EMS	238
Figure D 36: Question 36: The percentage of people responding “Agree” to: Management review and auditing are important in terms of:.....	239
Figure D 37: Question 37: The percentage of people responding “Agree” to the question: Your organisation requires a number of:.....	241
Figure D 38: Question 38: Your organisation has a high turnover of permanent staff	241
Figure D 40: Question 40: What percentage of your time is dedicated to the role of Environmental Manager?	246
Figure D 41: Question 41: How many people are involved in your environmental team?	246

LIST OF TABLES

Table 1: Question 8: Does your organisation maintain certification to other standards? If so which ones?	41
Table 2: Overview of Key standards (*-CO ² and GHG emissions reduction related, #-resource management systems related	45
Table 3: General Requirements of Key Standards	47
Table 4: Requirements present in one or more of the 13 standards that relate to the establishing of objectives and processes necessary to produce results complicit to the standard	49
Table 5: Requirements present in one or more of the 13 standards that relate to implementing the processes agreed in the planning phase	51
Table 6: Requirements present in one or more of the 13 standards that relate to the monitoring and measurement of the processes agreed in the planning phase	55
Table 7: Requirements present in one or more of the 13 standards that relate to the continual improvement of the processes agreed in the planning phase	57
Table 8: Chi Squared testing Results	69
Table 9: Results of final Factor analysis	125
Table 10: A Table of the Combined Results from stage 1 and 2 of the Data Analysis	129
Table 11: Question 8: Does your organisation maintain certification to other standards? If so which ones?	139
Table 12: A Synopsis of the Factor and Question Compositions	155

LIST OF TABLES FOR APPENDIX C

Table C 1 Example of Factor Analysis carried out on Question Using the Likert-type 5 point scale	189
Table C 2: Factor Analysis of Individual Cases	191
Table C 3: P Values Results for potential relationship between the Factors and the method of organisational categorisation (Size)	193
Table C 4: P Values Results for potential relationship between the Factors and the method of organisational categorisation (Type)	195
Table C 5: P Values Results for potential relationship between the Factors and the method of organisational categorisation (Stage of Certification)	197

Table C 6: P Values Results for potential relationship between the Factors and the method of organisational categorisation (Question 20a) 200

Table C 7: Factor Grouping for Question 20a..... 202

Table C 8: P Values Results for potential relationship between the Factors and the method of organisational categorisation (Question 20e) 205

LIST OF TABLES FOR APPENDIX D

Table D 1: Question 8: Does your organisation maintain certification to other standards? If so which ones? 213

LIST OF ABBREVIATIONS

ISO 14001	BS EN ISO 14001:2004
ISO 9001	BS EN ISO 9001:2008
CSR	Corporate Social Responsibilities
CRC	Carbon Reduction Commitment Energy Efficiency Scheme
EMAS	Environmental Management and Audit Scheme
EMS	Environmental Management System
GHG	Greenhouse gas
ISO	International Organization for Standardization
ND	Nonconformities database
PAS 99	Publically Available System 99:2006
QMS	Quality Management Systems
SE	Small enterprise
SME	Small to medium sized enterprises
BIS	The Department for Business Innovation and Skills
<i>TQM</i>	Total quality Management
UKAS	United Kingdom Accreditation Service
VSME	Very small to medium enterprises
VSE	Very small organisations

1 Introduction to Thesis Aim and Structure

1.1 Introduction

This chapter will define the aim and outline the structure of this thesis, as well as the key decisions that influenced the development of both of these factors.

The proceedings chapters will show that research in to ISO 14001 is essentially based on inductive reasoning and as such conclusions provided are weak or potentially incorrect. Furthermore, hypotheses, derived from small numbers of specific examples, are used as explanations for the behaviours of organisations that are inheritably diverse. In response, a research design based on deductive reasoning has been developed. This process of reasoning has seen the development of a general statement, in this instance a research aim, to reach logical conclusions. This research will be directed by data to derive more specific hypotheses, as discussed in chapter 2 (Trochim, 2006).

The use of a deductive approach to the research has impacted the research process. The data examined in the initial stages of the research has led to the development of three research objectives.

1.2 Research Aim

ISO 14001 is the fastest growing of the ISO Standards related to Environmental Management Systems; however existing research has been small scale and anecdotal. This research aims to confirm or dispute the present discussions and assumptions surrounding the motivations and barriers to certification to ISO 14001. Through deductive reasoning this research will provide a comprehensive investigation into the barriers and motivations experienced in its implementation. It is proposed that more comprehensive opportunities for organisational categorisation may also be defined.

1.3 Research Process

Figure 1 provides an explanation of the research process and it's correlation to each chapter.

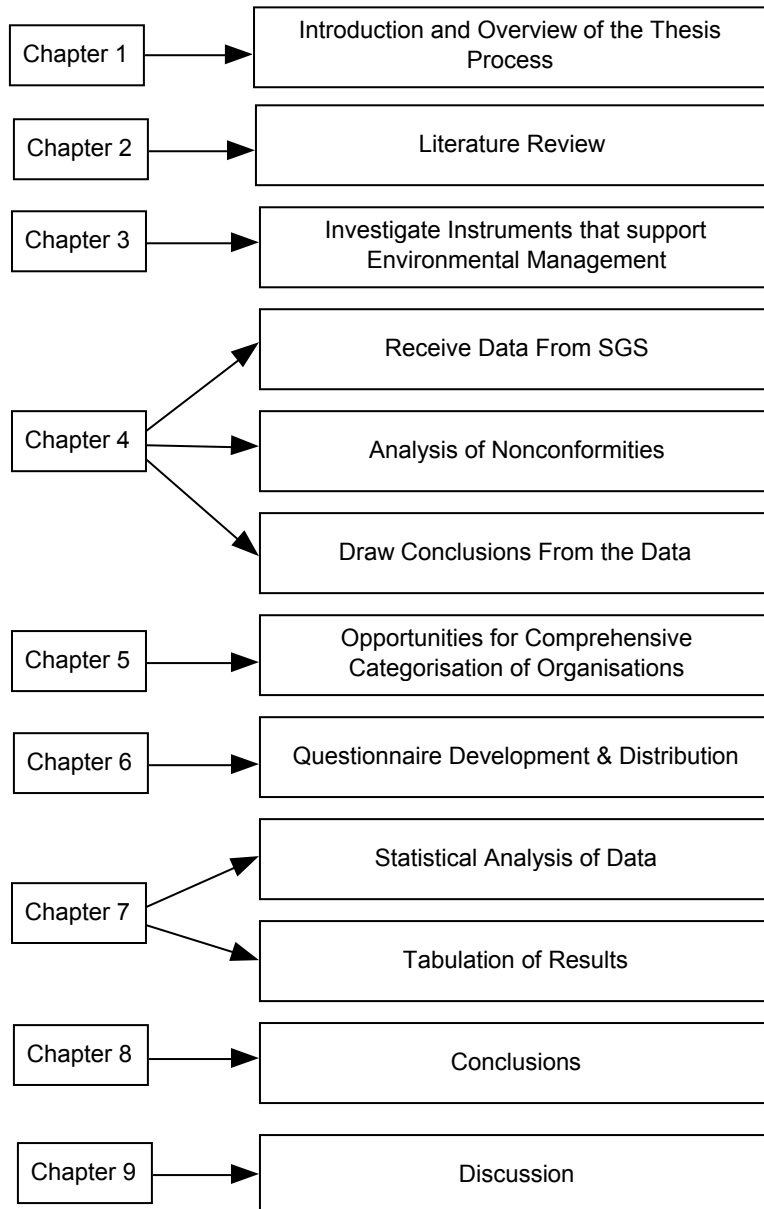


Figure 1: Thesis Research Process

References

TROCHIM, W. M. K. (2006, 20/10/06). "Deduction & Induction." Retrieved 03/04/13, 2013.

2 Environmental Management Systems and the Motivations and Barriers to their Implementation

2.1 Introduction

Corporate Social Responsibility (CSR) is a familiar term to many in both academia and industry. Organisations can no longer allocate only token resources to this as pressure from an increasingly environmentally conscious public and expanding statutory requirements brought about by national and international policies drive organisations to invest in CSR. Meanwhile companies are looking for information, support and publicity to demonstrate success (Brady, 2005; Hui et al., 2001). However, a key concern highlighted in the CSR literature is the consistent lack of knowledge and experience within organisations to put requirements for CSR into practice (Cramer, 2005; Prajogo et al., 2012; Campos, 2012). The International Organization for Standardization (ISO) released ISO 26000 in 2010. This standard does not include requirements for certification as yet; it does, however, offer guidelines for social responsibility for organisations with the intention of developing common guidance on concepts, definitions and methods of evaluation. A considerable level of research has been undertaken to prove its need and worth (International Organization for Standardization, 2010).

At present CSR is used as an umbrella term to embrace concepts including; environmental management, community and public relations and corporate philanthropy and as such many authors fail to clearly address this issue of definition (Ziek, 2009; Castka et al., 2004). Lord Holme does offer a concise definition in The World Business Council for Sustainable Development publication "Corporate Social Responsibility: Making Good Business Sense", stating that:

"Corporate Social Responsibility is the continuing commitment by business to behave ethically and contribute to economic development while improving the

quality of life of the workforce and their families as well as of the local community and society at large"

(Lord Holme and Watts, 2000)

However, within this same publication two other statements are also offered.

"CSR is about capacity building for sustainable livelihoods. It respects cultural differences and finds the business opportunities in building the skills of employees, the community and the government"

(Lord Holme and Watts, 2000)

And

"CSR is about business giving back to society"

(Lord Holme and Watts, 2000)

Beyond the potential confusion of these varied definitions and statements, what can be surmised is that CSR focuses on the management of the impacts of core business activities on the local and wider community and environment, although some definitions go further than others in terms of *specificity*.

A considerable collection of literature surrounds CSR that offers a variety of conclusions as to how best to meet this specific agenda. However, this literature clearly agrees that an outcome of interest has been an increase in voluntary instruments designed to support improvements in environmental management and corporate greening such as BS EN ISO 14001:2004 (ISO 14001), The Carbon Trust Standard and PAS 99:2006 (PAS 99) (Heras and Arana, 2010; Hopwood et al., 2005; Alberini and Segerson, 2002). Consequently, environmental management is often adopted as a key component in the development of CSR policies (Gelbmann, 2010).

2.2 Organisational Size

In agreement with Checkland (1992), although discussing systems in a more specific context, Heras and Arana (2010) clearly identify a need for further study

into voluntary models for environmental management in Small to medium sized enterprises (SME). The marked development of these voluntary instruments over the last two decades has been noted (Delmas and Montiel, 2008) and the subsequent commitment by companies to adopt standards of environmental management beyond those required by legislative compliance. This research has been concerned with environmental management as an aspect of CSR and consequently the plethora of instruments available to support improvements in environmental management within companies, the complexities of implementation, and investigations of opportunities for improvement through integration. For the purpose of this research, SME and smaller organisation categories will be defined in terms of employees numbers and turnover as stated from the European Union (European Union, 2005), Figure 2. A more detailed discussion on SME composition is provided by Zorpas (2010) *“Environmental management systems as sustainable tools in the way of life for the SME and VSME”*.

Enterprise category	Headcount	Turnover
SME's	< 250	≤ € 50 million
SE's	< 50	≤ € 10 million
VSE's	< 10	≤ € 2 million

Figure 2: Organisation Category by size (European Union, 2005)

SME make up the vast majority of businesses in Europe (Alberini and Segerson, 2002; Hillary, 2004), and account for 99.8% of organisations in the UK and a minimum of 90% across Europe (Pimenova and Vorst, 2004). Hillary (2004) continues to discuss the concept of SME in relation to environmental management, suggesting that, small organisations (SE) and very small organisations (VSE) such as sole traders and partnerships will have very few similarities to those employing 249 people and that, although there is a lack of knowledge regarding this sector, the EU regards engaging SME in environmental improvements as a vital part of the drive towards sustainable development. When discussing micro organisations Zorpas (2010) concurs with Hillary (2004) and further states his opinion that these organisations, in general; have mono-service or product offerings and are disproportionally affected by

economic pressures. Additionally, he considers that they are restricted in scope through; little access to further training and to the new requirements of the market, they do not participate in knowledge transfer or develop cross-organisation federation whilst producing high levels of waste.

The Department for Business Innovation and Skills (BIS) (BIS, 2008) provides annual figures on the composition of UK private sector enterprises. This data show that UK private sector enterprises falling within the categories of SME constituted 99.88%, SE's 99% and VSE's 95% in 2008. These sizes of organisations provided the following proportions of the total employment in 2008: 48.43% for SME, 38.2% for SE's and 26.3 for VSE's. In relation to private sector turnover 47.95% was generated by SME, 34.7% by SE's and 20.6% by VSE's. These data are provided in more detail in Figure 3. This demonstrates that within the broad category of SME companies are both socially and economically important. Additionally, SME have positive impacts in entrepreneurship and innovation within a market place (Heras and Arana, 2010).

Whole UK Economy at the Start of 2008	Number			Percent		
	Enterprises	Employment (/ 1,000)	Turnover (/ £ million)	Enterprises	Employment	Turnover
No of Employees	4,871,290	30,154	3,219,313	100.0	100.0	100.0
0 or 1	3,767,145	4,347	264,913	77.3	14.4	8.2
2-4	641,175	1,935	214,784	13.2	6.4	6.7
5-9	238,625	1,651	182,798	4.9	5.5	5.7
10-19	125,400	1,730	196,148	2.6	5.7	6.1
20-49	60,370	1,872	258,584	1.2	6.2	8.0
50-99	18,975	1,322	177,425	0.4	4.4	5.5
100-199	9,385	1,312	173,310	0.2	4.4	5.4
200-249	1,950	436	75,665	0.0	1.4	2.4
250-499	3,795	1,317	278,689	0.1	4.4	8.7
500 or more	4,470	14,232	1,396,998	0.1	47.2	43.4

Figure 3: The Composition of UK Organisations (BIS, 2008)

Arguments regarding correlations between the financial turnover and environmental impacts of companies are still active (Yin and Schmeidler, 2009; Giles, 2008; Rowland-Jones et al., 2005). However, it would seem reasonable to assume that an organisation category that accounts for 99.8% of all the organisations in the UK, 47% of total revenue and 48% of employment would also account for a substantial percentage of the overall environmental impact of

UK businesses (Pimenova and Vorst, 2004). Furthermore, Pimenova and Vorst (2004) offer an estimation of the environmental impact attributable to SME to be as high as 70% of the total for UK private sector. Although, with reference to research undertaken in six European Union countries, Pimenova (2004) concludes that the total is more likely to be in the region of 50% bringing it in line with the relative proportions of turnover and employment of SME. An argument for the initially higher percentage would be the impact arising from the economies of scale not experienced by smaller organisations and therefore not included in calculation methodologies (Kenny and Gray, 2009; Carbon Trust; DECC, 2009). Zorpas (2010) confirmed this confusion, highlighting that the heterogeneous nature of SME makes generalisation about environmental issues very difficult.

Through investigation into the opinion of SME in relation to instruments supporting environmental improvements and by reviewing the requirements dictated by these instruments, focus can be given to the specific areas of concern raised. In conjunction with this a better understanding of the overlap and opportunities for the development of synergies within specific instruments will allow the development of improved processes of implementation and management. In turn, this will provide process simplification and resources savings, (Zorpas, 2010) and consequently making these instruments seem to provide more attractive opportunities for SME and smaller organisations.

2.3 Environmental Management within Organisations

For any business the most important factors for survival are to remain profitable, competitive and increase or maintain market share. However, with green consumerism playing an ever larger part in the world economy, businesses must treat their operational impact on the local and wider environment as a fundamental aspect of policy development and organisational behaviour and demonstrate engagement through better environmental management (Aiyub et al., 2009)

Environmental management has historically been driven by command and control regulations stemming from broad principles or objectives introduced at

international level, which have become ratified through international treaties or conventions (Brady, 2005). Whilst regulatory controls have been attributed with driving substantial improvements in the reduction of industrial pollution they have also experienced criticism for being inflexible and not cost-effective (Hui et al., 2001). Consequently, the direction of control mechanisms for environmental management has subsequently moved towards taxes and tradable permits but these have also been found to be insufficient in dealing with the complexities of the emissions of multiple pollutants, for example (Ziegler and Nogareda, 2009). Prompted by these insufficiencies increased development and diffusion through the agency of private or nongovernmental organisations have been seen in recent decades; encouraging organisations to reach beyond legislative compliance (Delmas and Toffel, 2008). There is considerable, although not uniform agreement that these private instruments are both beneficial and have the ability to run concurrently with existing command and control policies (Alberini and Segerson, 2002; Arimura et al., 2008).

By far the most commonly used, and so discussed, of these instruments are BS EN ISO 14001:2004 (ISO 14001) and the Environmental Management and Audit Scheme (EMAS) with substantial levels of research literature dedicated to their application (Campos, 2012; Delmas and Montiel, 2008; Giles, 2008; Hillary, 2004; Hillary and Burr, 2011). However, a plethora of different specifications, standards, protocols and projects exist that fall under the remit of specific instruments for environmental management and offer organisations possible opportunities to commence and improve their environmental management and control (Figure 4). This is true even if the initial design of the instrument was not focused directly on the environment, such as BS EN ISO 9001:2008 (ISO 9001), which focuses on the requirements for a Quality Management Systems (QMS) and ensuring compliance to operational procedures which may, or may not, include environmental caveats. The greenhouse gas (GHG) protocol (The Greenhouse Gas Protocol, 2004) discusses the increased number of voluntary instruments that have emerged to promote environmental management and support organisations in the setting, implementation and tracking of GHG reduction targets. This protocol also

highlights the opportunities of participation in voluntary programmes including resource savings, providing public recognition and early action to pre-empt future regulations. Figure 3 represents a conceptual model of instruments designed to highlight both the sheer abundance of available instruments but, also the seemingly minimal interaction between them.

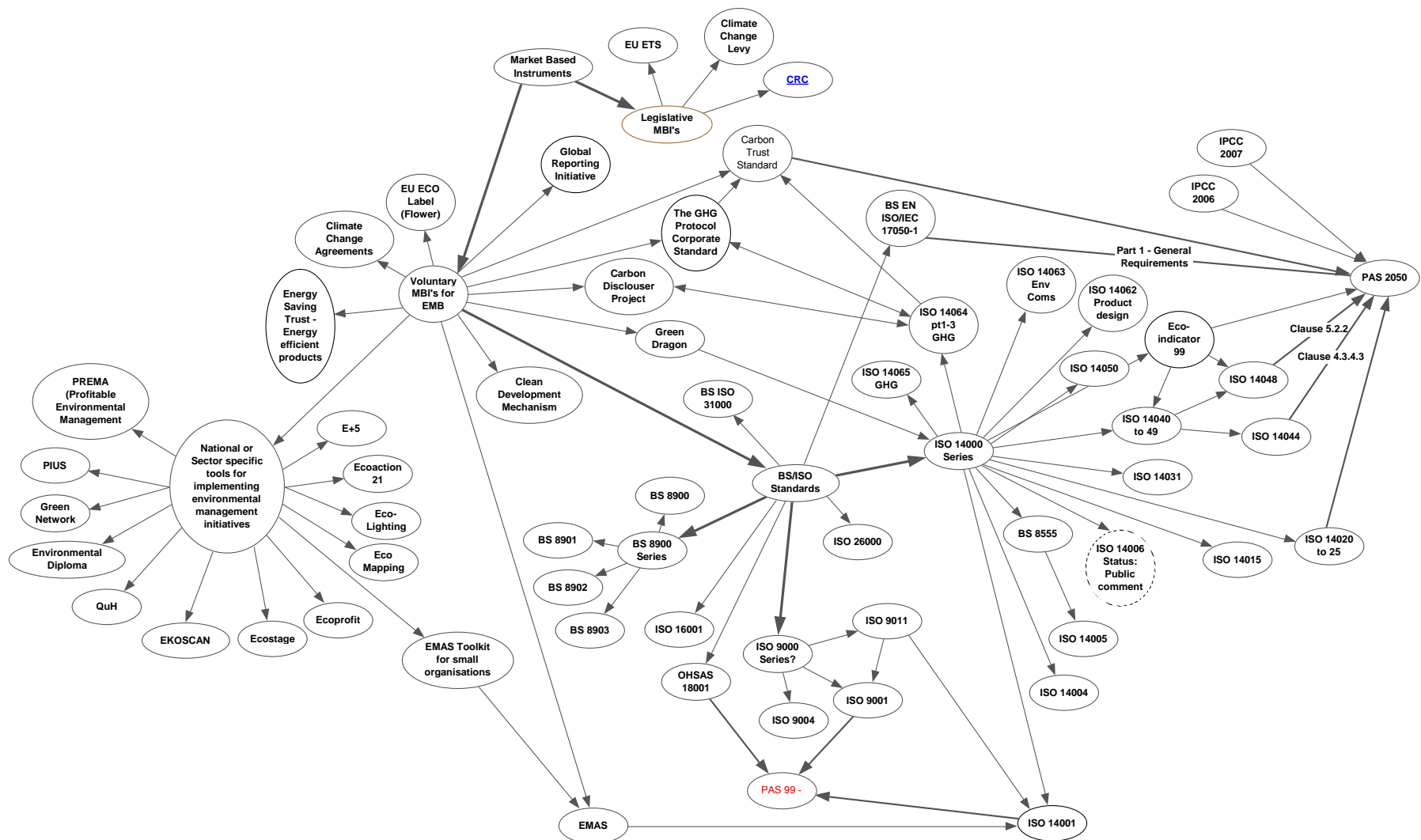


Figure 4 - Map of instruments that Offer Support for Improvements in Environmental Management

Comparative analysis of the above instruments has been undertaken in this field, but is very much in its infancy, with research focusing on only a small percentage of the available instruments and with few examples available (Heras and Arana, 2010; Castka and Balzarova, 2008; Beltrán et al., 2010). The majority of the literature available undertakes analysis of the drivers, barriers, obstacles and opportunities for implementation of ISO 14001 and EMAS yet neglects the composition of the instrument under review and the subsequent challenges faced (Hillary, 2004; Zorpas, 2010; Perez-Sanchez et al., 2003). For example; Aiyub (2009) states that, *“ISO 14001, for example, will become a selling point for providing competitive edge for business.”* An assumption can be made, although it is not stated by Aiyub, that ISO 14001 is being used as a representative example of the available instruments. In the context of voluntary instruments verses command and control legislation, Arimura et al (2008) ask “Is a voluntary approach an effective environmental policy instrument?” Again the context of the paper focuses primarily on ISO 14001 and neglects the other instruments that may be applicable such as BS 8555, ISO 16001 and carbon calculation and energy management in their entirety (Arimura et al., 2008). This predominance of interest in the application of ISO 14001 occurs frequently in the majority of the available literature where the existence of other instruments and their potential correlations with ISO 14001 and EMAS are left unexplored. Consequently, further Investigate into the similarities and differences between the different instruments available to support organisations that wish to adopt or improve in the implementation of environmental management is required. Thereby creating a knowledge base capable of demonstrating opportunities for integration and resource saving.

2.4 Motivations and Barriers to the Implementation of Instruments That Support environmental management in SME

It is possible that differences may exist between the obstacles and motivations experienced by large organisations and the smaller organisations that fall within the category of SME when undertaking the decision to improve their

environmental management (Aiyub et al., 2009; Heras and Arana, 2010; Hillary and Burr, 2011). Managers within SME may have different opinions and concerns related to their individual strengths and weaknesses and wants and needs. These would arise from the organisation's size, attributes, knowledge base, availability of resources, organisational culture and sector, which all might have an impact on every aspect of their success in terms of improvements in environmental management (Zorpas, 2010). All of these contribute to the need to review the development of environmental management separately from larger organisations, which may have greater and wider resources to deal with the requirements of these instruments at all levels (Perez-Sanchez et al., 2003).

It is often stated that SME may face diseconomies of scale when implementing objectives for environmental improvement (Heras and Arana, 2010). Campos (2012) goes as far as to state that the benefits of an Environmental Management System (EMS), namely ISO 14001, will mainly be experienced by larger organisations as the turnover of SME dictates a lower return on the cost of certification. Perez-Sanchez (2003) cites an inherent lack of expertise and a pressure on the management of resources as barriers specific to small organisations. These, among other potential obstacles and disincentives, are discussed in the literature (Zorpas, 2010; Hillary, 2004; Fresner, 2004). A point that is not raised in the reviewed literature is the initial cost of obtaining many of the instruments. A copy of a standard such as ISO 14001 must also be purchased at circa £80 and is required before a decision can be reached if the instrument is suited to the objectives of the organisation.

The implementation of EMS is regularly stated as not being a part of normal business practice or deemed necessary to be integrated with normal business practices within SME (Zorpas, 2010; Halila, 2007). This may be because SME perceive their individual environmental impacts to be low, and consequently of little concern (Pimenova and Vorst, 2004). However, as SME as a category are responsible for approximately 50 % of private sector turnover in the UK and Europe the cumulative effect of individual SME is significant. Castka (2004) suggests that barriers to implementation of EMS or other CSR projects are built

on perceptions rather than to any real knowledge of the actual cost and resource requirements incurred. Addressing this perception of excessive drain on resources will be an aim of this research. In a more positive light (Gelbmann, 2010) suggests SME often show excellent responsibility performance although are commonly unaware of it and as such do not seek the benefits open to them in promoting this to their clients (Gelbmann, 2010). It is clear that there is considerable disparity in opinion regarding the behaviour of SME undertaking a position of improved environmental management, specifically implementing ISO 14001 (Zorpas, 2010; Hillary and Burr, 2011; Hui et al., 2001). Therefore, it is necessary to develop a clear understanding of the certification and implementation processes for ISO 14001 and the issues experienced by organisations of all sizes. This will allow the development of proposals for improvement.

Hillary (2004) highlights the key barriers to the uptake of environmental management to be: the resources required, understanding and perceptions regarding requirements and benefits, the process of implementation and the organisation's attitudes and culture. Finally, SME very often fall outside the remit of legislative controls, such as the EU TES or the CRC Energy Efficiency Scheme (CRC) (formerly known as the Carbon Reduction Commitment). However, SME must still ensure compliance to relevant environmental legislation and an EMS can support so doing.

Rondinelli and Vastag (2000) highlight the lack of methodological requirements to gain accreditation to ISO 14001, stating that the standard merely assumes an organisation has an EMS in place able to deal with its environmental impact. Rondinelli and Vastag (2000) argue that certification only implies that regulatory mandates are achieved and that implementations do go beyond legal requirements, but there is no way to verify this. If results are publicised, the lack of standardisation of the methodology means results cannot offer independently verifiable transparency. Additionally, this need for only 'self-formulation' of data means that there is no possibility to offer comparisons between similar organisations (Wu et al., 2008).

Focus has initially been given to instruments as a whole with some investigation into ISO 14001 as a point of reference. However, international and governmental pressures have also been directed at a more specific aspect of organisations' impacts, specifically carbon management and reduction. The UK Climate Change Act of 2008 was, internationally, the first piece of legislation to set a legally binding long term framework for carbon emission reductions (Office of Public Sector Information, 2008). The targets were initially set at a reduction of 60% of CO₂ emissions by 2050 from a 1990 baseline figure. However, this was subsequently raised to an 80% reduction following further recommendations from committees such as The Committee on Climate Change, increasing the pressure on government and subsequently organisations (Committee on Climate Change, 2010).

To help meet the targets dictated by the UK Climate Change Act 2008 the UK government launched, in April 2010, the Carbon Reduction commitment (CRC). This mandatory requirement necessitates disclosure of specific energy streams and the purchasing, and possible trading, of carbon tokens, equivalent to emissions (Department for Energy & Climate Change, 2010) (Carbon Trust, 2010). Purchasing of a carbon allowance will initially be required by the 5000 largest participants. However, the scheme has the potential to expand to a further 15,000 public and private sector organisations, presently only required to document energy usage (Environment Agency, 2010). If this were to be the case, organisations that fall within the SME brackets, and a number that fall within the SE bracket, would be required to participate fully in the scheme (BIS, 2008). It is proposed that organisations may receive advantages through early adoption of the requirements of the CRC. This being achieved through the use of relevant carbon management standards such as the Carbon Trust Standard or BS EN ISO 50001 (ISO 50001) (Carbon Trust; British Standards Institution, 2011). However, as the scheme annually publishes results, it may also be in organisations' interest to carry out minimal environmental improvements prior to inclusion so as to take maximum demonstrable benefit post inclusion.

Neglecting, at present the more cynical argument, that an organisation will wish to suspend environmental improvements until legally obliged to do so, but rather assuming a organisation will take advantage of this opportunity, then certain instruments may offer support. For example; The Carbon Trust's Standard is one of only two 'early action measures' available to organisations, in the first year of application, to strengthen their position within the ranking of the CRC league table. Therefore, although a voluntary tool, the Carbon Trust standard will provide financial, although admittedly unknown savings due to the nature of the scheme (Carbon Trust, 2010). Standards such as ISO 14001 require participants to define the aspects of their business activities that may impact on the environment and set relevant and realistic objectives. An SME presently involved with ISO 14001 may wish to see its possible future inclusion into the CRC scheme as part of its environmental policy agenda, under section 4.3.1 or section 4.3.2, legislative compliance and so begin to integrate instruments bringing about improved efficiencies (British Standards Institution, 2004).

Many of the instruments represented in figure 3 have been documented as offering considerable advantages to organisations, although the validity of this notion is still ardently debated. For example, Rondineli and Vastag (2000) have highlighted the negative implications of ISO 14001, but they do suggest that its implementation can provoke attitudinal, managerial and operational changes together with the attendant benefits. It was concluded by Hui et al (2001) that organisations suggested that the implementation of an EMS had a positive effect on business. As such the present body of literature is unable to allow clear conclusions to be drawn in relation to EMSs and their link to improved environmental performance (Prajogo et al., 2012; Nawrocka and Parker, 2009; Stevens et al., 2012; Hillary and Burr, 2011). Furthermore, the conclusions drawn by Nawrocka and Parker (2009) are based on a meta- study from 23 research articles which were themselves based on as little as one organisation's response to ill defined research processes. There is a clear need for further research to allow definitive conclusions to be drawn on this topic through a documented methodology incorporating a wider spectrum of data from clearly specified sources.

Yin and Schmeidler (2009) conclude that the use of ISO 14001 is in response to multiple pressures and, although certification provides only a pass fail measurement of success, internally, on organisations accomplishment can vary. They continue to argue that active integration with daily operations and other management standards, such as ISO 9001, will to a large extent instigate reports from organisations of a more favourable performance in relation to environmental management improvements and their experience with ISO 14001 implementation. When discussing future research opportunities Yin and Schmeidler (2009) firstly highlight the limitations within their own research which used a self-reporting methodology, highlighting the need for, but difficulties in, obtaining quantitative data and the need for sector specific research. Finally they conclude that *“in order to design measures to ensure integration, studies need to be done to find out why facilities demonstrate different levels of integration, and to understand performance change at facilities with different levels of integration”* and the need for in-depth case studies to achieve this.

Nawrocka and Parker (2009) expose the lack of continuity in the relationship between EMS and improved environmental performance. Goulder and Parry (2008) do shed some light on this, suggesting that evaluating the multiple costs and benefits of alternative instruments offers considerable theoretical and empirical challenges and, even when assessing a single dimension such as cost effectiveness, comprehensive assessment must still incorporate the intangible benefits of these instruments, for example business retention and/or development that certification may support. As such choosing the “ideal” instrument involves a combination of art and science (Goulder and Parry, 2008). This statement highlights the need to gain further understanding if instruments such as ISO 14001 are to better support improvements in environmental management and this process is to become a more manageable one. Although the benefits of ISO 14001 and EMAS have been fervently debated and their particular value to SME discussed, this is still a discussion in its infancy with arguments based largely on anecdotal evidence and small scale case studies that do not review the process in enough detail or allow for the diversities that exist within the multifaceted environment within which SME operate. It is

proposed that a methodology is required that goes beyond that of SME and non SME that enables a classification process to best highlight the barriers and motivations for EMS implementation within SME.

2.5 Conclusion/Future Objectives

It has been shown that there are considerable gaps in the present understanding of the potential benefits that voluntary standards offer organisations adopting a policy of improved environmental management. Furthermore, it is clear that organisations face issues both in terms of motivations and barriers when considering the reduction of their environmental impacts. However, these are not fully understood. It is proposed, through the aim of this research, that a better understanding of organisational structure and culture these can be better understood and subsequently categorised through the development of a related criterion. Furthermore, existing research into the individual standards is anecdotal at best and this field of research needs considerable development. For the purpose of further research it is proposed that an investigation based on ISO 14001 offers the best opportunity to contribute to the existing knowledge base because it is by far the standard with the highest rate of certification and the most discussed within the literature (Campos, 2012; Delmas and Montiel, 2008; Giles, 2008; Hillary, 2004; Hillary and Burr, 2011). Conclusions reached regarding this standard may also be of significance to the implementation of other voluntary instruments.

Detailed research is required into the individual clauses of multiple standards to assess potential suitability for integration. Furthermore, a careful and extensive investigation of the certification process and application of ISO 14001 is required to confirm or dispute the largely anecdotal opinions currently prevalent in the published literature (Gelbmann, 2010; Hillary, 2004; Zorpas, 2010). This investigation should also encapsulate any difference in the effect specific clauses have on organisations. This research will provide evidence to allow processes to be developed that improve both the implementation and integration opportunities available to bring about resource saving for participating organisations.

It has been suggested that the term SME is too encompassing to enable meaningful understanding of the diverse organisation operating within this sector. It also shows that SME's account for 99.9% of private sector UK organisations and 50% of the pollution generation. This research programme will investigate the multiple variables that may be used to test the validity of, and extend, current notions regarding the classification of organisations undertaking a process of improved environmental management. Additionally, it will attempt to relate the potential barriers to the implementation and management of an EMS to a range of structural and organisational variables found within organisations.

The literature review has highlighted gaps in knowledge of why and how organisations implement voluntary instruments for environmental management. Consequently, the following objectives have been adopted for this research:

1. Investigate the similarities and differences between the different instruments available to support organisations that wish to adopt or improve in the implementation of environmental management, thereby creating a knowledge base capable of demonstrating opportunities for integration and resource saving.
2. Develop a clear understanding of the certification and implementation processes for ISO 14001 and the issues experienced by organisations of all sizes. This will allow the development of proposals for improvement.
3. Develop a method for categorisation beyond that of SME and non SME that enables a classification process to best highlight the barriers and motivations for EMS implementation within SME.

References

- AIYUB, K., JAHN, J. M., ARIFIN, K. and AWANG, A. (2009) Environmental performance in small and medium sized enterprises (SME) certified to ISO 14001 in the United Kingdom. *International Business Management*, 3, 7.
- ALBERINI, A. and SEGERSON, K. (2002) Assessing Voluntary Programs to Improve Environmental Quality.
- ARIMURA, T. H., HIBIKI, A. and KATAYAMA, H. (2008) Is a voluntary approach an effective environmental policy instrument?: A case for environmental management systems. *Journal of Environmental Economics and Management*, 55, 281-295.
- BELTRÁN, J., MUÑOZURI, J., RIVAS, M. and GONZÁLEZ, C. (2010) Metrological management evaluation based on ISO10012: an empirical study in ISO-14001-certified Spanish companies. *Energy*, 35, 140-147.
- BIS. (2008, 11 March 2010 12:15:48). "Enterprise Directorate: Small and Medium Enterprise Statistics for the UK and Regions
- " Retrieved 4-07-10, 2008, from <http://stats.berr.gov.uk/ed/>.
- BRADY, J. (2005) *Environmental Management in Organizations The iema Handbook*, Bath, Earthscan.
- BRITISH STANDARDS INSTITUTION (2004) BS EN ISO 14001:2004 Environmental Management Systems Requirements with Guidance for use.
- BRITISH STANDARDS INSTITUTION (2011) BS ISO 50001:2011 Energy Management System BSI Standards Publication
- CAMPOS, L. M. S. (2012) Environmental management systems (EMS) for small companies: A study in Southern Brazil. *Journal of Cleaner Production*, 32, 141-148.
- CARBON TRUST The Carbon Trust Standard Rules. Carbon Trust.
- CARBON TRUST An Introduction to the Carbon Trust Standard Methodology. Carbon Trust.
- CARBON TRUST. (2010). "The Carbon Trust Reduction Commitment (CRC): the business opportunity." Retrieved 23/08/10, from <http://www.carbontrust.co.uk/cut-carbon-reduce-costs/reasons/impact-policy-legislation/pages/carbon-reduction-commitment.aspx>.
- CASTKA, P., BALZAROVA, M., BAMBER, B. and SHARP, J. (2004) How can SME Effectively Implement the CSR Agenda? A UK Case Study Perspective. *Corporate Social Responsibility and Environmental Management*, 11, 149.

- CASTKA, P. and BALZAROVA, M. A. (2008) The impact of ISO 9000 and ISO 14000 on standardisation of social responsibility--an inside perspective. *International Journal of Production Economics*, 113, 74-87.
- COMMITTEE ON CLIMATE CHANGE. (2010). "Climate Change Act." Retrieved 19/0810, from <http://www.theccc.org.uk/about-the-ccc/climate-change-act>.
- CRAMER, J. (2005) Organisation Learning about Corporate Social Responsibility. *Business Strategy and the Environment*, 14, 255-266.
- DECC (2009) UK's National Strategy for Climate and Energy: Transition to a low Carbon Society. IN CHANGE, D. O. E. A. C. (Ed.).
- DELMAS, M. and MONTIEL, I. (2008) The Diffusion of Voluntary International Management Standards: Responsible Care, ISO 9000, and ISO 14001 in the Chemical Industry. *Policy Studies Journal*, 36, No. 1, 65-93.
- DELMAS, M. and TOFFEL, M. (2008) Organizational responses to environmental demands: opening the black box. *Strategic Management Journal*, 29, 1027-1055.
- DEPARTMENT FOR ENERGY & CLIMATE CHANGE. (2010). "CRC Energy Efficiency Scheme " Retrieved 19/08/10, from http://www.decc.gov.uk/en/content/cms/what_we_do/lc_uk/crc/crc.aspx.
- ENVIRONMENT AGENCY. (2010). "CRC Energy Efficiency Scheme." Retrieved 19/08/10, from <http://www.environment-agency.gov.uk/business/topics/pollution/98263.aspx>.
- EUROPEAN UNION (2005) The New SME Definition User Guide and Model Declaration.
- FRESNER, J. (2004) Small and medium sized enterprises and experiences with environmental management. *Journal of Cleaner Production*, 12, 545-547.
- GELBMANN, U. (2010) Establishing strategic CSR in SME: an Austrian CSR quality seal to substantiate the strategic CSR performance. *Sustainable Development*.
- GILES, F. (2008) Assessing the effectiveness of your environmental management system. *Environmental Quality Management*, 18, 1-6.
- GOULDER, L. H. and PARRY, I. W. H. (2008) Instrument Choice in Environmental Policy. *Review of Environmental Economics & Policy*, 2, 152-174.
- HALILA, F. (2007) Networks as a Means of Supporting the Adoption of Organizational Innovations in SME: The Case of Environmental Management Systems (EMSs) Based on ISO 14001. *Corporate Social Responsibility and Environmental Management*, 14, 167-181.

- HERAS, I. and ARANA, G. (2010) Alternative models for environmental management in SME: the case of Ekoscan vs. ISO 14001. *Journal of Cleaner Production*, 18, 726-735.
- HILLARY, R. (2004) Environmental management systems and the smaller enterprise. *SME and Experiences with Environmental Management Systems*, 12, 561-569.
- HILLARY, R. and BURR, P. (2011) Evidence-based Study into the Benefits of EMSs for SME. DEFRA.
- HOPWOOD, B., MELLOR, M. and O'BRIEN, G. (2005) Sustainable development: mapping different approaches. *Sustainable Development*, 13, 38-52.
- HUI, I. K., CHAN, A. H. S. and PUN, K. F. (2001) A study of the Environmental Management System implementation practices. *Journal of Cleaner Production*, 9, 269-276.
- INTERNATIONAL ORGANIZATION FOR STANDARDIZATION. (2010). "ISO 26000 Social Responsibility." Retrieved 18/08/10, from <http://isotc.iso.org/livelink/livelink/fetch/2000/2122/830949/3934883/3935096/home.html?nodeid=4451259&vernum=0>.
- KENNY, T. and GRAY, N. F. (2009) Comparative performance of six carbon footprint models for use in Ireland. *Environmental Impact Assessment Review*.
- LORD HOLME and WATTS, R. (2000) Corporate Social Responsibility Making Good Business Sense. World Business Council for Sustainable Development
- NAWROCKA, D. and PARKER, T. (2009) Finding the connection: EMS and environmental performance. *Journal of Cleaner Production*, 17, 601-607.
- OFFICE OF PUBLIC SECTOR INFORMATION. (2008). "The Climate Change Act." Retrieved 18/08/10, from http://www.opsi.gov.uk/acts/acts2008/ukpga_20080027_en_2#pt1-pb1-l1q1.
- PEREZ-SANCHEZ, D., BARTON, J. R. and BOWER, D. (2003) Implementing environmental management in SME. *Corporate Social Responsibility & Environmental Management*.
- PIMENOVA, P. and VORST, V. D. R. (2004) The role of support programmes and policies in improving SME environmental performance in developed and transition economies. *SME and Experiences with Environmental Management Systems*, 12, 549-559.
- PRAJOGO, D., TANG, A. K. Y. and LAI, K. H. (2012) Do organisations get what they want from ISO 14001 adoption?: An Australian perspective. *Journal of Cleaner Production*, 33, 117-126.

- RONDINELLI, D. and VASTAG, G. (2000) Panacea, common sense, or just a label?: The value of ISO 14001 environmental management systems. *European Management Journal*, 18, 499-510.
- ROWLAND-JONES, R., PRYDE, M. and CRESSER, M. (2005) An evaluation of current environmental management systems as indicators of environmental performance. *Management of Environmental Quality*, 16, 211.
- THE GREENHOUSE GAS PROTOCOL (2004) A Corporate Accounting and Reporting Standard Revised Edition. Earthprint Limited.
- WU, S. J., MELNYK, S. A. and CALANTONE, R. J. (2008) Assessing the Core Resources in the Environmental Management System From the Resource Perspective and the Contingency Perspective. *IEEE Transactions on Engineering Management*.
- YIN, H. and SCHMEIDLER, P. J. (2009) Why do standardized ISO 14001 environmental management systems lead to heterogeneous environmental outcomes? *Business Strategy & the Environment* (John Wiley & Sons, Inc), 18, 469-486.
- ZIEGLER, A. and NOGAREDA, J. S. (2009) Environmental management systems and technological environmental innovations: Exploring the causal relationship. *Research Policy*, 38, 885-893.
- ZIEK, P. (2009) Making sense of CSR communication. *Corporate Social Responsibility & Environmental Management*.
- ZORPAS, A. (2010) Environmental management systems as sustainable tools in the way of life for the SME and VSME. *Bioresource technology*, 101, 1544-1557.

3 Potential Opportunities for the Integration of Voluntary Systems Management Standards

3.1 Introduction

ISO is aware that an essential requirement of management systems is their mutual compatibility and alignment which, they state, is of fundamental importance to the user community (De Grood and Hortensius, 2002). A rapidly growing number of organisations are undertaking certification for multiple standards, particularly ISO 14001 and ISO 9001 (BSI, 2008a; BSI, 2004a). Furthermore, they are attempting to do this in an integrated or semi integrated way with a holistic structure to capitalise on potential resource efficiencies (De Grood and Hortensius, 2002). ISO's 9001 and 14001 include an Annex B which identifies broad technical correspondence between the standards (Zeng et al., 2005). Previously, Wilkinson and Dale (2000; 1999) undertook studies into the theory and issues concerning the integration of ISO 14001, ISO 9001 and BS OHSAS 18001 (British Standards Institution, 2007). Despite concentrating on only three standards written by the same organisation and initially designed to have fundamental levels of correlation, Wilkinson and Dale (2000) highlighted five key issues associated with the integration of the standards. The issues were as follows:

1. *"Lack of a definitive definition for integration causes a range of approaches to be undertaken which would suggest various levels of success; efficiencies and overall value are achieved for the participating organisation. It is suggested, from analysis of the relevant literature, that this is still very much an issue with multiple and single implementation processes."*
2. *"The integration is not necessary favoured by standard writers or assessors and instead focus is being given to alignment. This point is disputed in the following paragraphs and in recent years has become actively encouraged by assessment bodies such as BSI through standards such as The Publicly Available Specification 99:2006 (PAS 99)."*

3. *“Due to the system content differences in individual systems scope may hinder integration. However, again PAS provides a provision for this in section 1, 4.1.1 and 4.1.3 for an integrated scope.”*
4. *“The motivation for integration has grown, not through a total quality management (TQM) approach, but instead through a wish to reduce administrative and auditing costs. Subsequently more substantial benefits are not being achieved. However, this is not necessarily an issue with integration itself but instead highlights a knowledge gap in participating organisations and presents a further resource saving opportunity.”*
5. *“The standards under discussion do not highlight organisational culture as important or an enabler for improvement nor do they address issues such as motivation and cooperation and that this failing will not be overcome through increased compatibility. However, there is an obvious argument that a simplified and user friendly system would encourage greater integration within a organisation and changes in organisational culture will theretofore be smaller and more easily achieved.”*

(Wilkinson and Dale, 2000; Wilkinson and Dale, 1999)

An investigation into the potential benefits of integration has been undertaken by Zeng et al (2005). This work, again, focused on only ISO 9001 and ISO 14001 due to their stated similarity and compatibility. The work by Zeng et al (2005) proposed that benefits of integration included; avoidance of duplication of procedures, reduced conflict of procedures and reduced requirements for resources. However, it was also proposed that technical guidance and support from certifying bodies would be required to achieve these benefits. (Zeng et al., 2005)

Work undertaken as part of this research (see chapter 7) sent 869 ISO 14001 certified organisations a questionnaire that, among other topics, asked organisations which standards they held certified for and, if applicable, the level to which the required policy and procedures for the separate standards were integrated. The return rate for the questionnaire was just over 10% providing a

sample of 88 organisations (Appendix D). Table 1 shows that 84% of respondents were certified to ISO 14001 and at least one other standard. Additionally, 42% of respondents held certification to ISO 14001 and at least two other standards. Of the other standards, certification held for ISO 9001 was the most common. This research shows that certification to multiple standards is common in an organisation holding certification for at least one standard. This research, therefore, supports the theory's of De Grood and Hortensius (2002) and promotes further investigation of those proposed by Zeng et al (2005).

Table 1: Question 8: Does your organisation maintain certification to other standards? If so which ones?

Patterns in Organisations Certification to Multiple Standards	Percentage of 88 Respondents
Organisations that have ISO 14001 and at least one other Standard	84%
Organisations that have ISO 14001 and at least two other Standards	42%
Organisations that have ISO 14001 and ISO 9001	72%
Organisations that have ISO 14001 and BS EN 18001	16%
Organisations that have ISO 14001 and other ISO standard (Not ISO 9001 or BS OHSAS 18001)	18%
Organisations that have ISO 14001 and another non ISO standard	23%

Ref: Appendix D Table D 1

In 2006 the British Standards Institution released PAS 99 (BSI, 2006d). This was, at the time of release, the first specification of requirements for an integrated management system. PAS 99 has been developed in accordance with Guide 72 (International Organization for Standardization, 2001), that defines the Guidelines for the justification and development of management system standards which includes section A.2.3, "Need for management system

standards". This sub clause asks the proponent of a management system to define the characteristics of its needs and identify the issues which have to be controlled and/or improved in order to satisfy the relevant interested party(s). Therefore, for PAS 99 to have been published it must have been comprehensively agreed that a need for such integration existed. This decision can be taken as evidence of the perceived benefits of the integration of multiple standards. Furthermore, BSI has released BS 8903:2010 Principles and framework for procuring sustainably – Guide (BS 8903) (BSI, 2010). This Standard makes reference to standards 5, 6, 9 and 11 listed in Table 2 as both potential resources and methodologies, further showing the inherent compatibility of these standards. Guide 72 provides a table, annex B, that defines the six common components of an ISO management system standard; Policy, Planning, Implementation and Operation, Performance Assessment, Improvement and Management Review. These areas correlate not only with other ISO Standards, British (BS), European (EN) or International (ISO) but, in many instances, also with, separate carbon management systems (International Organization for Standardization, 2001).

However, providing guides and systems for integration does not necessarily consider the heterogeneous nature of organisations and their motivations for integration. It is therefore possible that, through the translation of specific requirements and the individual solutions reached to overcome them, the homogenous nature of these standards may be lost during application (Wilkinson and Dale, 2000).

As part of this research study, participants responding to a questionnaire were asked whether they agreed with the statement "Our organisation integrates its policy and procedures for multiple standards". Figure 5 shows that 70% agree or strongly agree with this statement. However, when the qualitative data, recorded in the same questionnaire is reviewed, the bullet pointed text following Figure 5, it is clear that considerable discrepancy exists in the actual levels of integration achieved. Furthermore, existing literature does not take into account the specific clauses of which standards comprise (De Grood and Hortensius,

2002; Wilkinson and Dale, 2000), or go beyond the comparison of two standards (Zeng et al., 2005). This work will provide a better understanding on the potential opportunities for integration based on the components of multiple standards.

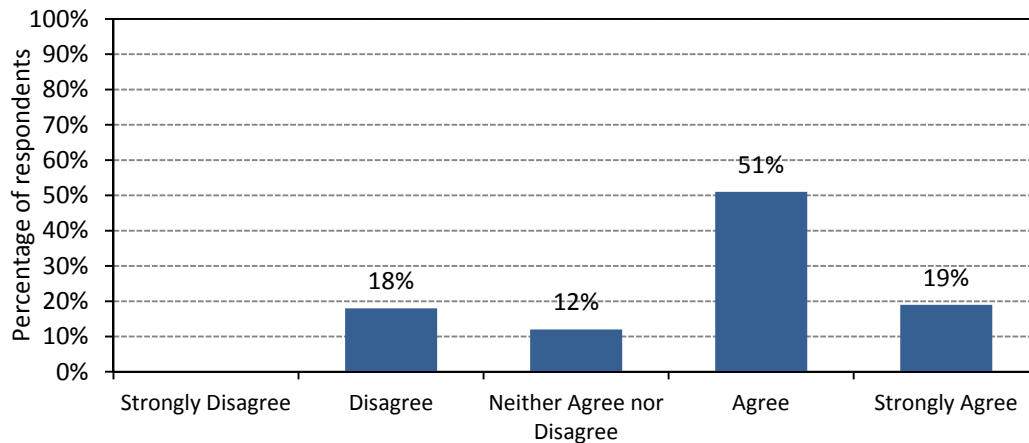


Figure 5: Question 9: Our organisation integrates its policy and procedures for multiple standards (Percentage taken from 88 respondents).

Ref: Appendix D Figure D 9

- *We have developed an Integrated Management System which integrates 9001 and 14001.*
- *We have integrated procedures where they are generic to the standards.*
- *The policy is not integrated but the procedures are*
- *Have just completed a single system audit for 14001, 9001, 18001 and 27001 and passed. Is saving business £1000's in terms of auditor costs and time spent on managing systems. This was driven by a forward thinking Compliance Director, not by Senior Management*
- *We try but our QA system is part of a European group system with another assessment body*
- *We use the same CR policy across the organisation, even though our ISO14001 certification only covers our developments over a £5m cost threshold.*
- *It is a business objective to fully integrate the existing 4 x ISO's currently held by 2013.*
- *We used too and have a joint audit. We haven't changed the procedures since giving back the certificate.*

- *The scope for each standard is not the same which makes integration impossible at present.*
- *Parent organisation has procedures we need to follow*
- *Part integration*
- *Integrate wherever possible i.e Producers for Training, Control of Documents/Records, Internal Audits etc are applicable to Quality, Environmental & H&S Standards*
- *We only integrate the 18001 & 14001 (the 9001 is stand alone)*
- *We use an integrated management system approach*
- *Currently operate integrated system to 9001, 14001 and 18001.*
- *Of necessity these are run by different teams in the organisation.*

3.2 The Standards

For the purpose of this work a comparison of the requirements of 13 specific standards was undertaken. The criterion for inclusion was that: The specific standard offered improvements to an organisation's management systems and that there was no legal requirement to implement the standard. The standards reviewed do not comprise all of the available options for improved environmental management. Additionally, the standards chosen are not of lesser or greater value than those excluded but rather offer an opportunity to review possible synergies and draw conclusions on resource saving that may be achieved through the integration of common aspects with the other standards. Table 2 identifies the standards reviewed in this research and provides an overview of their aims.

Table 2: Overview of Key standards

Reference Number	Title	Overview	Source of further information
1	The Carbon Trust Standard*	Awarded to organisations for measuring, managing and genuinely reducing their carbon emissions and committing to reducing them year on year. (Carbon Trust, 2008)	http://www.carbontruststandard.com/
2	The GHG Protocol Corporate Standard*	An accounting and reporting methodology intended to support organisations to identify, calculate, and report GHG emissions in an accurate, complete, consistent, relevant and transparent format. (World Resources Institute and World Business Council for Sustainable Development, 2004)	http://www.ghgprotocol.org/standards/corporate-standard
3	Carbon Disclosure Project*	Established as a global standard for emissions and energy reporting for major organisations. An independent not-for-profit organization holding and managing the largest database of primary corporate climate change information in the world.	https://www.cdproject.net/en-US/Pages/HomePage.aspx
4	Global Reporting Initiative* (GRI)	A network-based system created to offer an internationally comparable sustainability reporting framework. (Global Reporting Initiative, 2006)	http://www.globalreporting.org/Home
5	ISO 14064* (1,2&3)	The requirements, specifications and principles for the quantification and reporting of greenhouse gas (GHG) emissions and removals at an organisational level. Including the requirements of design, development, management, reporting and verification of a GHG inventory (BSI, 2006a; BSI, 2006b; BSI, 2006c)	http://www.iso.org/iso/catalogue_detail?csnumber=38381
6	PAS 2050*	<i>Provides a method for measuring the greenhouse gas (GHG) emissions from goods and services at the request of Defra (Department for Environment, Food and Rural Affairs) and the Carbon Trust" (BSI, 2008c; BSI, 2008b).</i>	http://www.bsigroup.com/Standards-and-Publications/How-we-can-help-you/Professional-Standards-Service/PAS-2050
7	PAS 99	<i>The requirements specification for an integrated management system (IMS). Developed from the six common requirements of ISO guide 72(BSI, 2006d)</i>	http://www.bsigroup.com/en/Assessment-and-certification-services/management-systems/Standards-and-Schemes/PAS-99/
8	EMAS	A voluntary tool designed to enable organisations to evaluate, report and improve their environmental performance. (Eco-Management and Audit Scheme, 1995)	http://www.iema.net/emas
9	BS 8901	A standard developed specifically for the events industry, designed to support the industry in operating in a more sustainable way (BSI, 2007a)	http://www.bsigroup.co.uk/en/Assessment-and-Certification-services/Management-systems/Standards-and-Schemes/BS-8901/

10	BS EN ISO: 50001:2012	Representing a systematic and best practice approach to energy management and efficiency in building. Based on existing national standards and initiatives (BSI, 2011).	http://www.bsigroup.co.uk/en/-Energy-Management-Systems/
11	ISO 14001/ISO 14004#	Internationally recognised standards that define the requirements, development and implementation of an EMS (BSI, 2004a; BSI, 2004b)	http://www.iso.org/iso/iso_14000_essentials
12	ISO 9001/ISO 9004#	Internationally recognised standards that define the requirements, development and implementation of a Quality Management System (QMS). (BSI, 2009; BSI, 2008a)	http://www.iso.org/iso/iso_catalogue/management_standards/iso_9000_iso_14000/iso_9000_essentials.htm
13	OHSAS 18001#	A nationally recognised standard used to convey and promote a safe and healthy working environment by providing a framework that allows organisations to consistently identify and control health and safety risks, reduce the potential for accidents and aid legislative compliance (BSI, 2007b).	http://www.bsigroup.com/en/Assessment-and-certification-services/management-systems/Standards-and-Schemes/BSOHSAS-18001/

3.3 Investigation of the opportunities for integration

The study examines the requirements of the 13 standards to ascertain possible synergies and opportunities for management and manpower resource savings through there integration.

In order to asses possible synergies and opportunities for resource efficiencies the specific clauses of the 13 standards were reviewed. Of these standards 1 to 6 are carbon specific and 7 to 13 focus on the wider environment. The requirements have been categorised by their correlation to five titles: Firstly general requirements and then plan, do, check and act, the process approach employed by a number of ISO standards including; PAS 99, ISO 14001 and ISO 9001 (BSI, 2008a; BSI, 2006d; BSI, 2004a).

3.3.1 General Observations Regarding Standards Requirements

Table 2: Overview of Key standards represents the requirements present in one or more of the 13 standards that relate to the “general” requirements necessary to produce results complicit to the standard.

Table 3: General Requirements of Key Standards

Standard Title	General	
	Industry Specific	Other Standards Required
1. Carbon Trust Standard (Standard Rules)		X
2. The GHG Protocol Corporate Standard		
3. Carbon Disclosure Project		X
4. Global Reporting Initiative		X
5. ISO 14064		
6. PAS 2050		X
7. PAS 99		
8. EMAS		
9. BS 8901	X	
10. ISO 50001		
11. ISO 14001		
12. ISO 9001		
13. OHSAS 18001		

Table 2: Overview of Key standards represents the requirements present in one or more of the 13 standards that relate to the “general” requirements necessary to produce results complicit to the standard.

Table 3 depicts the general requirements for the 13 standards which relate to whether the standard is designed for a particular industry or if certification to other standards is required. It has been shown that:

- Standards 1, 3, 4 and 6 require the use of other standards, making reference to standards 2 and 5.
- Standards 2 and 5 supply their own methodology and standard number 5 is only designed to offer an accounting framework.
- Standards 7 to 13 do not require certification to other standards, beyond legal compliance and are not industry specific, except standard 9.

3.3.2 Standards' Requirement Regarding "Planning"

Table 4 represents the requirements present in one or more of the 13 standards that relate to the "planning" processes necessary to produce results complicit to the standard.

Table 4: Requirements present in one or more of the 13 standards that relate to the establishing of objectives and processes necessary to produce results complicit to the standard

Standard Title	Plan								
	Scope	Defined Operational Boundaries	Policy required	Specific Documentation Defining Key Elements of the Standard	Defined Objectives	Define, Document and communicate responsibilities and roles, and authorities	Operational Control	Defined methodology	Methodology for definition of emission types and explanation on how to calculate
1. Carbon Trust Standard (Standard Rules)		X	X		X		X	X	X
2. The GHG Protocol Corporate Standard		X			X			X	X
3. Carbon Discloser Project		X			X			X	X
4. Global Reporting Initiative		X			X			X	X
5. ISO 14064 -	X	X		X	X	X	X	X	X
6. PAS 2050	X	X			X	X		X	X
7. PAS 99	X		X	X	X	X	X		
8. EMAS	X		X	X	X	X	X		
9. BS 8901	X		X	X	X	X			
10. ISO 50001	X		X	X	X	X	X		
11. ISO 14001	X		X	X	X	X	X		
12. ISO 9001	X		X	X	X	X	X		
13. OHSAS 18001	X		X	X	X	X	X		

From Table 4 it can be seen that:

- Standards written by ISO and EMAS (Numbers 7 to 13) require the inclusion of a policy where as Carbon emissions reduction standards 1 to 4 do not require a policy but do require defined operational boundaries. Standards 5 and 6 are related to carbon emissions but written by ISO require both.
- Standards written by ISO and EMAS (Numbers 7 to 13) require a description of the main elements of the standard to be documented in a way that complies with a further procedure for document and record control.
- All 13 standards require defined objectives. Standards 5 to 13 require objectives to be managed at relevant levels within the organisation and ensure that they are; monitorable, measurable and defined by a time frame (BSI, 2004a). Only Standard 3 sets out specific targets for reduction. These are expressed as a percentage of base CO₂ emissions (Carbon Trust).
- Standards 5 to 13 require formal documentation of specific roles, responsibilities and authorities related to the management of the system.
- Standards 5 to 13 require documented evidence that operational controls are in place. All ISO standards have a specific clause dedicated to this topic.
- Standards 1 to 6, those predominantly related to carbon emissions reduction, provide a defined methodology for assessing emissions levels by activity, including conversion factors to CO₂ measurement, or reference to a location for them.

3.3.3 Standards' Requirements Regarding “Doing”

Table 5 represent requirements present in one or more of the 13 standards that relate to implementing “doing” the processes agreed in the planning phase.

Table 5: Requirements present in one or more of the 13 standards that relate to implementing the processes agreed in the planning phase

Standard Title	Do						
	Identification & evaluation of aspects, impacts and risks	Documented procedures	Stakeholder identification & communication	Identification of Legal and other requirements	Contingency planning	Competence, training and awareness	Internal Communication
1. Carbon Trust Standard (Standard Rules)		X	X			X	X
2. The GHG Protocol Corporate Standard		X					X
3. Carbon Disclosure Project		X					X
4. Global Reporting Initiative		X					X
5. ISO 14064		X				X	X
6. PAS 2050		X					X
7. PAS 99	X	X		X	X	X	X
8. EMAS	X	X		X	X	X	X
9. BS 8901	X	X	X			X	X
10. ISO 50001	X	X		X		X	X
11. ISO 14001	X	X		X	X	X	X
12. ISO 9001	X	X		X	X	X	X
13. OHSAS 18001	X	X		X	X	X	X

Standard Title	Do				
	Monitoring & Measurement of relevant data	Externally communication & publication of results	Break down of energy consumption	Quantification of GHG emissions and/or Carbon Footprint	Calculation or support tools provided
1. Carbon Trust Standard (Standard Rules)	X	X	X	X	X
2. The GHG Protocol Corporate Standard	X	X	X	X	X
3. Carbon Discloser Project	X	X	X	X	
4. Global Reporting Initiative	X	X	X	X	X
5. ISO 14064	X		X	X	X
6. PAS 2050	X		X	X	X
7. PAS 99	X				
8. EMAS	X	X			
9. BS 8901	X	X			
10. ISO 50001	X		X		
11. ISO 14001	X				
12. ISO 9001	X				
13. OHSAS 18001	X				

From Table 5 it can be seen that:

- Standards 7 to 13 require documented procedures for identifying areas of organisational activity that may be controlled and influenced. The organisation must also determine areas of its activity that could have a significant impact on its operational ability or its ability to comply with procedures documented through requirement to the standard.
- There are three specific requirements that all of the 13 standards reviewed require: First, documented evidence, including the quality of this documentation: Second, a level of internal communication capable of communicating the relevant requirements of the particular standard to all levels within organisation. Third, organisations must record information specific to the individual standards requirements and the objectives set.
- Only standards 1 and 9 require identification and communication with stakeholders during the planning stage of standards requirements. This is not to be confused with the external publication of results to stakeholders.
- Standards 6 to 13 require that training is sufficient for individuals undertaking an activity that has potential to impact on the areas, determined by the organisation, to have significant impact on its operational ability or its ability to comply with procedures documented through requirement to the standard. Standard number 5 also requires specific training but only for individuals directly linked to the management of the standard.
- Of the standards that require external communication of their achievements against the objectives set, only number 9 is published by ISO and only requires that stakeholders be informed of progress in relation to performance (BSI, 2007a). Standards 1 to 4 also require external communication of results.
- External communication of achievements against objectives is a requirement of standard number 8, EMAS. This is the only aspect in which this standard and number 11, ISO 14001, diverge in their requirements.
- Standards numbered 1 to 6 and number 10 require measurement and recording of specific energy streams and consumption. These figures are used for developing a framework for their reduction and measurement of achievement against the objectives.

- Standards 1 to 6, those associated directly with carbon emission reductions, require quantification of GHG emissions and/or the production of a Carbon Footprint figure. Standards 7 to 13 do not require the results to be formatted in any particular format.

3.3.4 Standards' Requirements Regarding "Checking"

Table 6 represents the requirements present in one or more of the 13 standards that relate to the monitoring and measurement of the processes agreed in the planning phase

Table 6: Requirements present in one or more of the 13 standards that relate to the monitoring and measurement of the processes agreed in the planning phase

Standard Title	Check							
	Evaluation of compliance	Internal audits	Handling of non conformities	External assessment, accreditation or payment	Energy Monitoring	Specific energy reduction objectives	Energy Reduction a requirement	Targets defined by Standard
1. Carbon Trust Standard (Standard Rules)	X	X		X	X	X	X	X
2. The GHG Protocol Corporate Standard	X	X		X	X	X		
3. Carbon Disclosure Project	X	X		X	X	X		
4. Global Reporting Initiative	X	X		X	X	X		
5. ISO 14064	X	X	X		X	X	X	
6. PAS 2050	X	X			X	X		
7. PAS 99	X	X	X					
8. EMAS	X	X	X	X				
9. BS 8901	X	X	X	X				
10. ISO 50001	X	X	X	X	X	X	X	
11. ISO 14001	X	X	X	X				
12. ISO 9001	X	X	X	X				
13. OHSAS 18001	X	X	X	X				

Table 6 represent requirements present in one or more of the 13 standards that relate to the monitoring and measurement (“checking”) of the processes agreed in the planning phase. The figure shows that:

- All 13 standards require a documented evaluation of compliance for at least the requirements dictated by the standard. Standards published by ISO (5 to 7 and 9 to 13) require evidence of compliance to relevant legislation as well as compliance with any other requirements to which the organisation subscribes.
- A formalised auditing process that reviews the organisation’s compliance to the predetermined criteria is required by all 13 standards.
- Those standards published by ISO (5 to 7 and 9 to 13) as well as standard 8 (EMAS) require the participating organisation to maintain procedures for dealing with any occurrence of non compliance to the predetermined criteria of the individual standard. This procedure must document the nonconformity and an action taken to mitigate its impact. It must also document the corrective and preventative action employed. Furthermore, there must be a review process for the subsequent level of successes (BSI, 2008a).
- Standards 1 to 4 and 8 to 13 offer the opportunity to source external certification from an accredited body. Standards 5 to 7 are deemed specification only standards that provide ‘best practice’ procedures with no opportunity to directly achieve certification.

3.3.5 Standards' Requirements Regarding "Acting"

Table 7 represents the requirements present in one or more of the 13 standards that relate to the continual improvement of the processes agreed in the planning phase

Table 7: Requirements present in one or more of the 13 standards that relate to the continual improvement of the processes agreed in the planning phase

Standard Title	Act
	Management review
1. Carbon Trust Standard (Standard Rules)	
2. The GHG Protocol Corporate Standard	
3. Carbon Discloser Project	
4. Global Reporting Initiative	
5. ISO 14064	
6. PAS 2050	
7. PAS 99	X
8. EMAS	X
9. BS 8901	X
10. ISO 50001	X
11. ISO 14001	X
12. ISO 9001	X
13. OHSAS 18001	X

Table 7 represent requirements present in one or more of the 13 standards that relate to the continual improvement of the processes agreed ("acting") in the planning phase. The figure shows that:

- Standards 7 to 13 require that an organisation undertakes meetings at planned intervals. The meetings must address predetermined criteria which include the status of corrective and preventive action and recommendations for improvement. The output of the meeting must also include any actions decided in relation to the relevant policy, objectives targets and any other elements of the standard.

3.4 Conclusion

- Existing literature has focused primarily on the integration of only a small number of standards and specifically those owned by the same organisation, e.g. ISO.
- This research has shown that a considerable proportion of organisations maintain certification to multiple standards and therefore potential exists for their integration.
- Discrepancies exist in the interpretation of the term integration between organisations undertaking multiple certifications.
- Existing literature has neglected the composition of the standards specific requirements in conjunction with identifying potential opportunities for integration.
- Significant commonality exists between the specific requirements of all of the 13 standards reviewed. However, there is greater continuity between those standards that are carbon specific (1 to 6) and those that are more generic (7 to 13).
- Integration of multiple standards provides an opportunity for greater resource efficiency to be achieved.
- Standards written by ISO or EMAS have greater similarities than those that are not and standards dealing with CO₂ specifically have greater similarities than those that focus on the wider environment.

3.5 Discussion

This research has shown that there is significant commonality between the specific requirements of the 13 standards reviewed. The research provides a knowledge base that demonstrates the opportunities that exist for integration of requirements across the standards reviewed. It is proposed that resource saving may be achieved through the removal of unnecessary duplication of tasks and employing an integrated audit process.

However, this research has also shown that a divide exists between standards that deal specifically with CO₂ management (standards 1 to 6) and those that tackle wider environmental issues (7 to 13). It also shows that those standards

written by ISO or EMAS (standards 5 to 13) have significant similarities. Standards 1 to 6 require the application of specified methodologies and data collection, where as standards 7 to 13 allow more flexibility. However, this flexibility evident in standards 7 to 13 allows the incorporation of these methodologies so not excluding opportunities for integration. Furthermore, standards 7 to 8 and 10 to 13 have a requirement to show compliance to other organisational responsibilities, which would include the requirements of other standards.

References

- BRITISH STANDARDS INSTITUTION (2007) BS OHSAS 18001:2007 Occupational health and safety management systems - Requirements. BSI.
- BSI (2004a) BS EN ISO 14001:2004 Environmental Management Systems Requirements with Guidance for use.
- BSI (2004b) BS ISO 14004:2004 Environmental management system - General guidelines on the principles, systems and support techniques. BSI.
- BSI (2006a) BS ISO 14064-1:2006 Greenhouse gases - Part 1: Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals. BSI.
- BSI (2006b) BS ISO 14064-2:2006 Greenhouse gases - Part 2: Specification with guidance at the project level for quantification, monitoring and reporting of greenhouse gas emission reductions or removal enhancements. BSI.
- BSI (2006c) BS ISO 14064-3:2006 Greenhouse gases - Part 3: Specifications with guidance for the validation and verification of greenhouse gas assertions. BSI.
- BSI (2006d) PAS 99:2006 Common Management Systems Requirements as a Framework for Integration. BSI.
- BSI (2007a) BS 8901:2007 Specification for a sustainable event management system with guidance for use. BSI.
- BSI (2007b) BS OHSAS 18001:2007 Occupational health and safety management systems - Requirements. BSI.
- BSI (2008a) BS EN ISO 9001:2008 Quality Management Systems Requirements. BSI.
- BSI (2008b) Guide to PAS 2050 How to assess the carbon footprint of goods and services BSI.
- BSI (2008c) PAS 2050:2008 Specification for the assessment of the life cycle greenhouse gas emissions of goods and services BSI.
- BSI (2009) BS EN ISO 9004:2009 Managing for the sustained success of an organization - A quality management approach. BSI.
- BSI (2010) BS 8903:2010 Principles and framework for procuring sustainably – Guide. BSI.
- BSI (2011) BS ISO 50001:2011 Energy Management System BSI Standards Publication
- CARBON TRUST The Carbon Trust Standard Rules. Carbon Trust.

- CARBON TRUST (2008) Carbon Footprinting: An Introduction for Orginsations. Carbon Trust.
- DE GROOD, R. and HORTENSIUS, D. (2002) ISO Guide 72 on Justification and Drafting of Management System Standards. *Spotlight*. March 2002 ed.
- DELMAS, M. and TOFFEL, M. (2008) Organizational responses to environmental demands: opening the black box. *Strategic Management Journal*, 29, 1027-1055.
- ECO-MANAGEMENT AND AUDIT SCHEME (1995) EMAS. EMAS.
- GELBMANN, U. (2010) Establishing strategic CSR in SME: an Austrian CSR quality seal to substantiate the strategic CSR performance. *Sustainable Development*.
- GLOBAL REPORTING INITIATIVE (2006) Sustainability Reporting Guidelines. 3 ed., GRI Amsterdam
- GONZÁLEZ-BENITO, J. and GONZÁLEZ-BENITO, Ó. (2008) Operations management practices linked to the adoption of ISO 14001: An empirical analysis of Spanish manufacturers. *International Journal of Production Economics*, 113, 60-73.
- INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (2001) Guide 72
- Guidelines for the justification and development of management system standards. 1 ed.
- ROWLAND-JONES, R., PRYDE, M. and CRESSER, M. (2005) An evaluation of current environmental management systems as indicators of environmental performance. *Management of Environmental Quality*, 16, 211.
- WILKINSON, G. and DALE, B. G. (1999) Integrated management systems: an examination of the concept and theory. *The TQM Magazine*, 11, 95-104.
- WILKINSON, G. and DALE, B. G. (2000) Management system standards: the key intgration issues. *Journal of Accounting and Public Policy*, 214, 9.
- WORLD RESOURCES INSTITUTE AND WORLD BUSINESS COUNCIL FOR SUSTAINABLE DEVELOPMENT (2004) The Greenhouse Gas Protocol - A Corporate Accounting and Reporting Standard USA.
- YIN, H. and SCHMEIDLER, P. J. (2009) Why do standardized ISO 14001 environmental management systems lead to heterogeneous environmental outcomes? *Business Strategy & the Environment (John Wiley & Sons, Inc)*, 18, 469-486.

ZENG, S. X., TIAN, P. and SHI, J. J. (2005) Implementing integration of ISO 9001 and ISO 14001 for construction. *Managerial Auditing Journal*, 20, 394-407.

4 Patterns in Nonconformities Raised During the ISO 14001 Audit Process

4.1 Introduction

Chapter 1 has shown that there is a clear need to develop an understanding of the implementation process for ISO 14001 and the issues experienced by a variety of SME. The sequence of implementing an EMS, such as ISO 14001, requires an organisation to develop processes that meet the defined requirements of the standard. This may will include; an environmental policy, management of environmental legislation, improved resource efficiencies and communication of measurable objectives both internally and externally (Briggs, 2006; Burke and Gaughran, 2006; Delmas, 2004; Hillary, 2004; Delmas, 2001; Yin and Schmeidler, 2009). However Fresner (2004) highlights the limitations of standards such as BS EN ISO 14001:2004 Environmental Management System – Requirements with Guidance for use (ISO 14001) (BSI, 2004a) as unable to provide explicit tools to actually achieve these goals. Therefore, it can be expected that organisations will experience differing outcomes and levels of success. Yin and Schmeidler (2009) conclude that the use of the same management tool, ISO 14001, in response to multiple pressures is often internally heterogeneous in its composition, although externally portraying a standardised image. It is through better understanding of this heterogeneity that will allow the development of proposals for improvement.

The most common formalised structure for an EMS is defined in the document ISO 14001. This standard is not an EMS but rather a manual that guides allowing organisations to achieve an EMS that conforms to a specified standard.

Yin and Schmeidler (2009) suggest that, although portraying uniformity, the idiosyncratic nature of EMS implementation leads to significant heterogeneity in their implementation. However, whilst the disparity of success is not disputed it is clear that considerable discrepancies exist in opinion regarding the application of ISO 14001. Hillary and Burr (2011) provide a comprehensive

review of these issues. Generally, discussions in the literature focus on: the motivations for the implementation and growth of the standard as well as the perceived and actual benefits that accrue; the barriers to success and the mechanism for the measurement of these outcomes (Briggs, 2006; Zorpas, 2010; Zorpas et al., 2008; Van Hemel and Cramer, 2002; Aiyub et al., 2009). It is also clear that the methods used to research this topic are often rudimentary and the results anecdotal rather than derived from structured research (Fresner, 2004; Yin and Schmeidler, 2009). Conclusions have been drawn from small scale investigations and applied to diverse and unrelated examples in relation to organisation size and activity (Hillary, 2004; Williams et al., 2000). An expanded investigation utilising the knowledge gained from existing research and methodologies is required to better clarify such discussion.

The purpose of this chapter is not to expressly attribute reasoning to perceived behavioural patterns in relation to EMS and more specifically ISO 14001 implementation. This would require detailed qualitative data from participating organisations. Instead this is an investigation into the ISO 14001 audit process and nonconformities arisen as a consequence. This examination allows conclusions to be drawn from a substantial data set that tests anecdotal evidence, developing theories. The International Organization for Standardization definition is used here, i.e. a nonconformity is as a “*non-fulfilment of a requirement*” (See Section 4.5.3 of ISO 14001 (BSI, 2004a).

4.2 Developing an Understanding of nonconformities Occurring During the ISO 14001 External Audit Process

Attempts to define the processes involved with the implementation and management of ISO 14001 most often start with categorising the organisations. However, these categories are often limited to employee numbers or turnover expressed in terms of either small to medium sized enterprise (SME < 250 employees) or non SME, ≥ 250 employees (Aiyub et al., 2009; Heras and Arana, 2010; Fresner, 2004). Surveys from the UK government (BIS, 2010) and European Union (2005) show that SME make up 99.9% of all UK private

sector organisations. Clearly this challenges the utility of such classifications (Hillary, 2004).

However, employing organisational size as a method of categorisation could have benefits as much of this data is detailed and freely available from a number of sources, including BIS. Furthermore this category, based on employee numbers, allows for more detailed taxonomies to be developed and for organisations to be subdivided beyond SME and non SME, as discussed by Zorpas (2010).

Hillary (2004) provides more detailed categories for organisations, although still utilising employee number. SE and very small enterprises (VSE), such as sole traders and partnerships will have few similarities to organisations employing 249 people. Furthermore, although there is a lack of knowledge regarding this sector the EU regards engaging SME in environmental improvements as a vital part of the drive towards sustainable development (Hillary, 2004).

In discussing EMS implementation within SME, Zorpas (2010) concurs with Hillary's (2004) view that SME does not offer an all encompassing category and that micro-enterprises will present unique characteristics. Zorpas (2010) expands the point stating that SME, in general have mono-service or product offerings and are disproportionately affected by economic pressures. Additionally, they are restricted through limited access to further training and to the new requirements of the market. Furthermore, they do not participate in knowledge transfer or develop cross organisation federation whilst producing high levels of waste.

Opportunity exists to categorise organisations by the industry sector to which they belong. Chapple (2001) discusses that the probability of an organisation successfully undertaking ISO 14001 implementation may be determined by discrete industry dynamics. Furthermore, discussions concerning the impacts of a structured approach to environmental management often assume that the manufacturing and service sector industries will demonstrate discrete characteristics (Burke and Gaughran, 2006; Sroufe, 2003; Vachon and Klassen, 2008).

Finally, an important limitation of the existing investigations into the adoption of ISO 14001 is the depth to which the content of the standard is reviewed. No work has been undertaken that considers organisations, specific motivations and available resources with their subsequent level of individual clauses of the standard (Yin and Schmeidler, 2009; Zorpas, 2010; Hillary and Burr, 2011; Hillary, 2004; Campos, 2012).

ISO 14001, as with a number of other standards produced by ISO, for example; ISO 9001 and OHSAS 18001:2007 (BSI, 2007b; BSI, 2008a), is structured on the Deming Cycle of plan, do, check, act. This cycle is followed to ensure continual improvement of a system and subsequently has a number of specific requirements based around this concept (Ammenberg and Sundin, 2005). ISO 14001 comprises of four sections and two annexes. Section four defines the requirements for accreditation and is divided into clauses 4.1, 4.2, 4.3, 4.4, 4.5 and 4.6 which relate directly to the Deming Cycle. These are further subdivided into 21 requirements; non-conformities are raised against these specific requirements during the audit process.

It is proposed that, as SME and non SME are assumed to experience different motivations and barriers to implementation, so they will perceive and manage the individual requirements of the standard with different degrees of success and failure. Through an investigation of organisations' responses to and achievement of the specific requirements of ISO 14001 section four (coupled with a comprehensive review of the validity of existing methods of categorisation), it is proposed that a better understanding can be achieved of processes and the true barriers that these organisations will face and how they might be related to organisation size and personnel resources.

4.3 Method

This research is based on data from 869 UK based organisations that had, or were in the process of obtaining, certification to ISO 14001 through a United Kingdom Accreditation Service (UKAS) accredited organisation. A programme of research has been undertaken utilising this data to ascertain whether patterns exist relating to organisation size and activity sector regarding the

occurrence of problems related to individual clauses of ISO 14001 during the external auditing process.

The nonconformities database (ND) comprises records of 8387 nonconformities raised during the certification processes for the 869 organisations over a six-year period. The data was transcribed to proprietary worksheet software to include information on organisation descriptors:

- An individual organisational reference (No specifics, including organisational names were provided).
- An industry classification number in both the French Nomenclature statistique des activités économiques dans la Communauté Européenne, commonly referred to as NACE classification method, and the European Accreditation of Certification Industry Classification (EAC) industry reference code.
- Geographical location of the organisation
- External audit visit type, number and date.
- The specific clause of ISO 14001 to which a raised non-conformity related.
- The organisational employee count.
- Time taken to rectify nonconformities raised during the certification process.

8387 clauses were admissible for this study as they contained the relevant information. No nonconformities were recorded against clause headings 4.3, 4.4 and 4.5 as these subtitles for groups of clause. The average percentages depicted in the graphs included in this section incorporate the full data set of 8387 clauses.

Of the multiple opportunities for categorisation presented by the entire data set, only certain organisational characteristics displayed patterns that warranted investigation. The decision as to whether further analysis of a category was viable was made through Chi squared testing to assess the statistical significance of the examined relationships (Greenwood and Nikulin, 1996). A p-value of below 0.05, or a confidence level above 95%, would cause a rejection

of the null hypothesis, that nonconformities related to classification references will be evenly spread across the range of ISO 14001 clauses. This would lead to the proposed relationship being eliminated.

Of the opportunities presented for classification of data no significance was seen when location was used as the classification identity. When the data was reviewed in terms of audit type; e.g. early renewal, extension of scope, pre-audit, stage 1 and stage 2 audits and surveillance audits no conclusions could be reached due to the spread and variability of the recorded visit types. Certain visit types were substantially unrepresented in the data set. A similar situation arose when the data was subdivided in relation to activity type beyond that of manufacturing and service sectors. The number of data relating to a particular sub-category was generally too small to be statistically useful. With a larger data set it may be possible to discern patterns which are not presently visible. For the current data set only organisational size and activity type (manufacturing and service sectors) offered opportunities for more in-depth investigation.

4.4 Results

Table 8 depicts the results of an investigation into the statistical significance of the examined relationships using the Chi Squared distribution test (Greenwood and Nikulin, 1996). The data was viewed in its entirety and subdivided by organisational size (Department for Business Innovation & Skills, 2010; European Union, 2005) and as to whether the organisation operated within the service or manufacturing sector. Furthermore, the individual relationship between categorisation type and clause number have been subjected to Chi squared testing. The checked cells in Table 8 represent results that show a confidence level of above 95% where the null hypothesis can be rejected.

Table 8: Chi Squared testing Results

ISO 14001 Reference		Total data Set	Categorisation by Organisational Size (Employee Number)				Categorisation by Industry Type	
Clause Number	Clause Title		0-9	10-49	50-249	250+	Manufacturing	Service
4.1	General requirements	*	*			*	*	*
4.2	Environmental Policy	*	*					
4.3	Planning	*						
4.3.1	Environmental Aspects	*		*		*	*	*
4.3.2	Legal and other requirements	*	*					
4.3.3	Objectives, targets and programme(s)	*						
4.4	Implementation	*						
4.4.1	Resources roles and responsibility and authority	*						
4.4.2	Competence, training and awareness	*	*					
4.4.3	Communication	*						
4.4.4	Documentation	*						
4.4.5	Control of documents	*			*			
4.4.6	Operational control	*	*	*		*	*	*
4.4.7	Emergency preparedness and response	*						
4.5	Checking	*						
4.5.1	Monitoring and measurement		*					
4.5.2	Evaluation of compliance	*		*		*	*	*
4.5.3	Nonconformity, corrective action and preventive action	*						
4.5.4	Control of records	*						
4.5.5	Internal audits	*	*					
4.6	Management review	*	*	*		*	*	*

The use of the Chi squared show specific clauses with significant occurrence levels outside the norm and therefore offers the opportunity to further subdivide organisations based on the occurrence of these clauses.

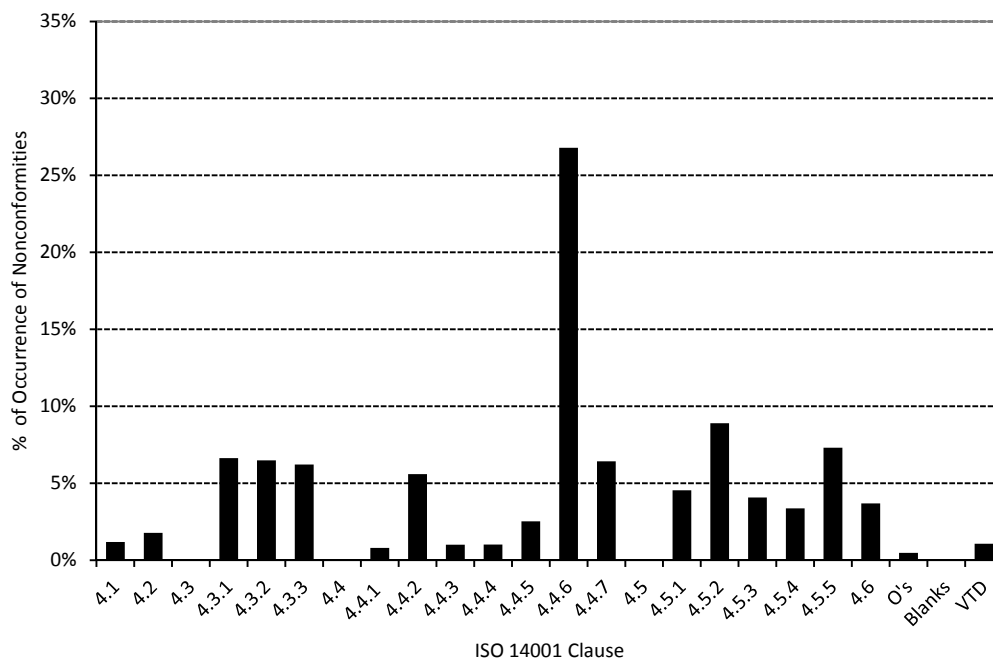


Figure 6: Percentage of Occurrence of Nonconformities for ISO 14001 clauses for all organisations

Figure 6 shows the spread of nonconformities across the entire ND and suggests that disparities exist in the percentage occurrence of nonconformities for examined clauses of ISO 14001. Table 8 displays that for all clauses except 4.3, 4.4 and 4.6 which are title clauses and 4.5.1 (Monitoring and Measurement) such disparities occur. This does not necessarily invalidate the importance of clause 4.5.1 rather that its occurrence falls within a normal distribution curve. Non-conformities for clause 4.4.6 (Operational Control) occur significantly more frequently than other clauses and therefore can be assumed to create a specific barrier to implementation. Whereas clauses 4.4.3 and 4.4.4, “communication” and “documentation” respectively are shown to occur with a low frequency and can therefore be assumed to present less of a barrier to implementation. However, from this data alone it is not possible to provide an explanation of the reasons for the disparities or provide options for categorisation.

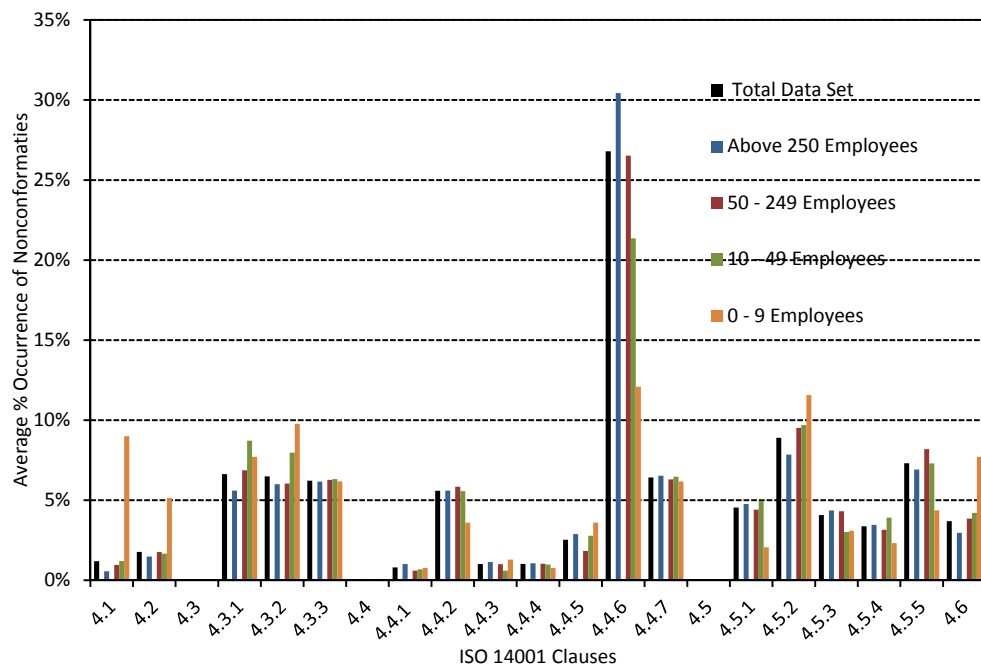


Figure 7: Percentage of Occurrence of ISO 14001 Nonconformities Categorised by Organisational Size

Figure 7 presents the percentage occurrence of individual clauses from the data set categorised by organisational size and shows there is a clear difference in occurrence rates.

Table 8 identifies clauses 4.1, 4.3.1, 4.4.6, 4.5.2 and 4.6 as having significant difference in occurrence rates in the ND when the data is subdivided in terms of both size (0-9 VSE, 10-49 SE, 50-249 SME & <250 employees) and organisational activity (service to manufacturing).

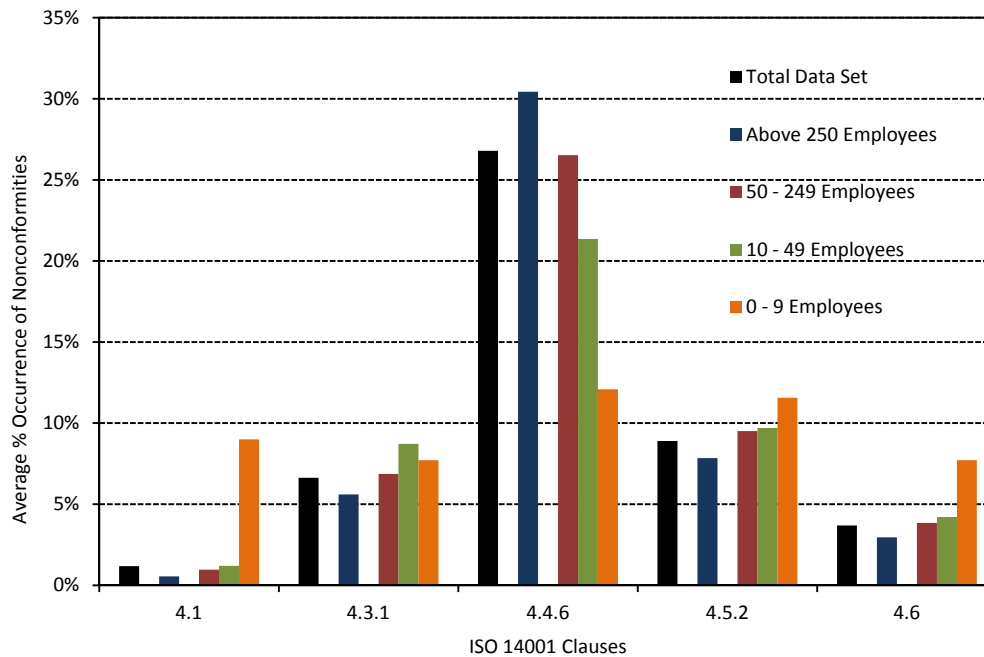


Figure 8: Percentage of Occurrence of ISO 14001 Nonconformities Categorised by Organisational Size for Specific Clauses

Through this process of further subdivision it is possible to better understand the variation in difficulty that a specific clause may cause organisations of certain sizes. Clause 4.1 relates to general requirements of the International Standard including the determination of the scope of certification. It can be seen that the occurrence of non-conformities increases for the smallest organisation and as such may warrant extra resources during the development of an EMS.

When clause 4.4.6 is further subdivided by organisational size it can be seen that non-conformities occur at different percentage rates for organisations of different sizes. This result suggests that a bespoke approach to EMS implementation related to organisation size would offer benefits. However, further resource efficiency may be made by operating a more generic approach to certain clauses which show minimal occurrences of non-conformities across

the data set, for example clauses 4.4.3 and 4.4.4, “communication” and “documentation” respectively. By treating individual clauses independently a streamlined yet tailored EMS could be implemented. Furthermore, organisations supporting EMS implementation will be able to offer relevant and targeted training and support.

As well as understanding the specific clauses that cause nonconformities the ND also allows the quantity of nonconformities generated by organisations of different sizes to be reviewed. Figure 9 shows the average nonconformities arising per visit, with visits taking place at circa six month intervals. Figure 9 shows that VSE receive the fewest nonconformities on the 4th visit and a rapid reduction in nonconformities over two years when compared to the behaviour of larger organisations.

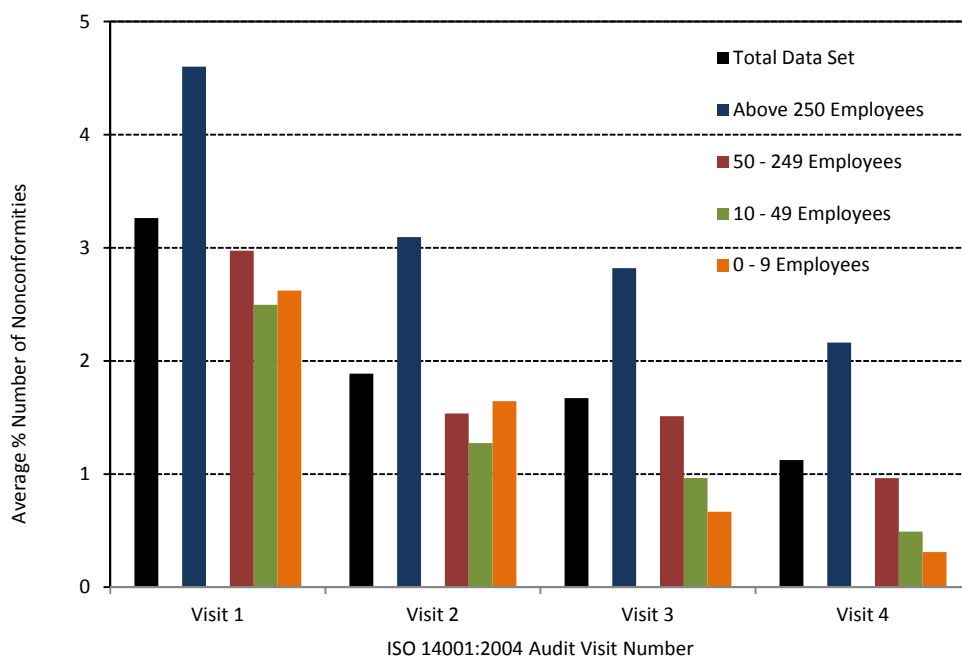


Figure 9: Average Number of Nonconformities occurring in relation to organisation size

The inclusion of Figure 9 highlights a potential contradiction in the existing discussions surrounding ISO 14001 that is at least inferred in much of the available literature (Hillary, 2004). A comprehensive review of 33 studies into EMS implementation was provided by Hillary (2004) and concluded that there

were a number of specific barriers, both internal and external, faced by VSE. It is outside of the scope of this study to dispute or confirm this conclusion; however the data displayed in Figure 9 does show that SME and particularly VSE record lower numbers of nonconformities and that they consistently reduce them over the 4 audits. This suggests further that for SME and VSE specifically; resources, capabilities, understanding and implementation although initially providing barriers these are rapidly overcome and are not potentially as great as perceived.

The data presented in Figure 9 is not, however, normalised by employee numbers, it depicts the average number of nonconformities raised by separate organisations employing specific numbers of employees. The initial exclusion of employee number relates to the homogeneity of the standard and its requirements which do not change dependent on organisational size.

In relation to average number of nonconformities received Chi Squared tests reveal that the only categories with variations that show a variation above the 95% confidence level of significance are between the categories SME and Non SME. However, these results suggest that categorisation through organisational size, as used in previous studies with considerable regularity, but often without explanation (Williams et al., 2000; Perez-Sanchez et al., 2003; Heras and Arana, 2010; Fresner, 2004), may not support a more detailed investigation of ISO implementation regarding the categorisation of organisations. This notion that organisational size may not be useful for categorisation is also proposed by Hillary (2004) and Zorpas (2010). That is to say that although there may be statistical significance in variation of nonconformity type between sub categories of SME there is no significant difference in the overall numbers of nonconformities they receive during the external audit process. As such, the suggestion in previous work that SME require substantial support in this process, or that they lack the resources or knowledge to respond to the nonconformities raised may be unfounded (Heras and Arana, 2010; Hillary, 2004). Furthermore, size is not, as previously suggested, a comprehensive

mode for categorisation and as such additional categories and categorisation methods should be sought.

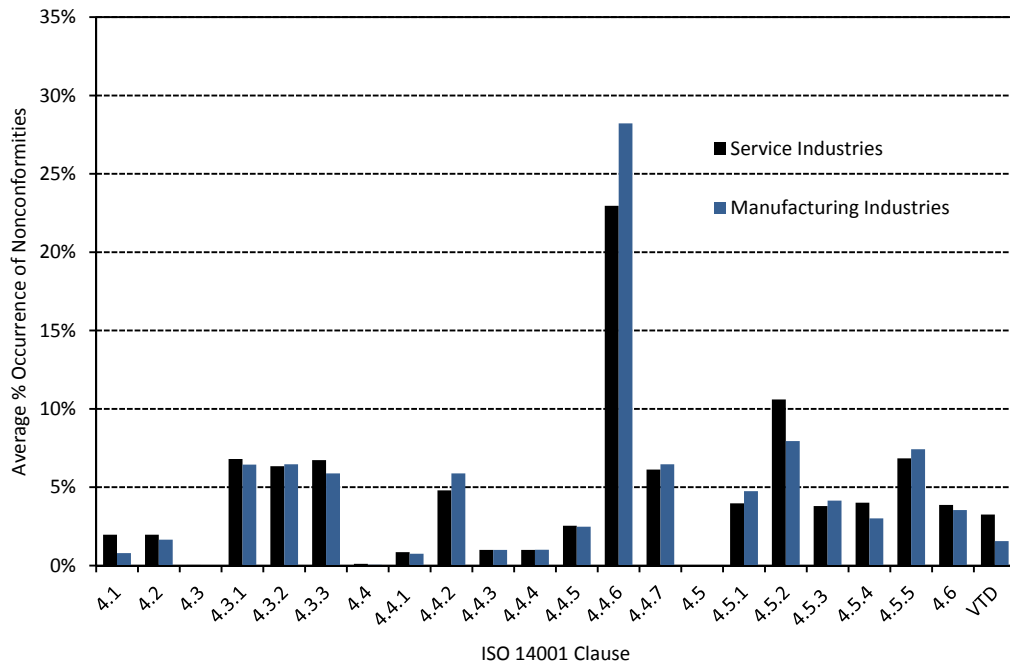


Figure 10: Percentage of Occurrence of Nonconformities Categorised by Organisational Sector

A further opportunity for categorisation, although not directly discussed in that context, is provided by Burke and Gaughran (2006); Sroufe (2003) and Vachon and Klassen (2008) who differentiate organisations by their activity, namely manufacturing and service sectors, in relation to the motivations and subsequent barriers to EMS implementation. However, Figure 10 shows that very little variation in occurrence patterns of nonconformities exist between the two sectors and no variations of statistical significance were observed. It is suggested, that although these two sectors superficially may appear to operate in different environments this does not translate to differences in the outcome of ISO 14001 implementation.

4.5 Conclusion

- Although extensive, discussion regarding ISO 14001 it is often based on anecdotal evidence or small sample size.

- Existing research in this field has attempted to categorise organisations simply by size and type, however, this research has shown that these methods are not as comprehensively useful as suggested.
- Previous investigations into ISO 14001 have not distinguished the individual clauses of ISO 14001 as investigation factors. However, this research has shown discernible patterns in their occurrence across a variety of organisations.
- It has been shown that specific clauses of ISO 14001 cause nonconformities during the certification process more regularly and therefore may be deemed to present greater barriers.
- Through a clearer understanding of the occurrence of nonconformities across multiple organisations it is proposed that more resource efficient approaches to EMS auditing and implementation can be developed.
- This research has shown that a smaller organisational size is not a limiting factor for success and the outcomes for different sectors do not show meaningful variation. Furthermore, smaller organisations would seem to adapt more quickly and with less difficulty to nonconformities raised in the audit process and so to EMS implementation.

Categorisation by organisational type, in this instance manufacturing and service based industries, show no discernible patterns in the occurrences of nonconformities.

- There is a need to develop more comprehensive methods of organisational categorisation if meaningful patterns in the barriers to implementation of EMSs are to be understood. Organisational size and type, whilst offering a cursory approach to categorisation are unable to fully expose the true underlying factors that affect ISO 14001 implementation.

4.6 Discussion

The research has highlighted significant patterns in the occurrence of nonconformities raised through the external audit process of ISO 14001, for example; the difference in organisations categorised as SME and Non SME and

organisation type. The data also suggests that inherently different organisations may well experience similar levels of difficulty with a particular clause but it does not indicate how these were overcome in the different environments.

The examination of the ND has provided an opportunity to derive previously unseen response patterns related to ISO 14001 implementation and on-going certification of 869 UK organisations. However, the data does not provide sufficient information to explain the reasons for the observed patterns to be explained. Further qualitative and quantitative research with individual organisations will be required to ascertain the reasons why their non-conformities arose and the processes that they undertook to achieve and manage their certification. Hillary (2004) and Zorpas (2010) both discuss the need to categorise organisations beyond SME and non SME and suggest a further subdivision of size in the SME category. However, without further research to verify this proposition, organisational size and industry sector as categorisation choices may not offer any more value than other distinguishing characteristics that might be used for categorising organisations, for example organisational structure . That is not to say there are no benefits associated with employing organisational size as a method of categorisation for SME; the data is detailed and freely available from a number of sources, including BIS. It is also a method of categorisation that allows subdivision of the total data set without the need for primary research and offers the benefit of continuation from existing research. However, this research shows that more in depth categorisation beyond SME may not offer any beneficial differentiation and that there is no evidence that this process offers the best opportunity to understand the variety of barriers that may be faced within this sector or how they might be overcome. The benefits of ISO 14001 and EMAS have been fervently debated and their particular value to SME discussed. However, previous studies reviewed in this research suggest that this is still a discussion in a state of flux with much of the argument based on anecdotal evidence rather than structured research (Heras and Arana, 2010; Zorpas, 2010; Burke and Gaughran). Previous studies have tended to be small scale and have not reviewed the process in enough detail or considered the diversity and multifaceted

environment which SME operate within. This research has indicated which aspects of ISO14001 cause significant barriers, how they relate to organisations of various sizes and type and the limitations of this choice of categories. However, if the reasons for the observed difficulties with specific clauses of ISO 14001 are to be fully understood a requirement exists to identify the characteristics of organisations that provoke these results. An improved understanding of the behavioural attributes influencing certification and implementation of an EMS is required and so a more meaningful set of categories need to be developed that allow specific barriers to be managed and more resource efficient practices to be employed.

References

- AIYUB, K., JAHN, J. M., ARIFIN, K. and AWANG, A. (2009) Environmental performance in small and medium sized enterprises (SME) certified to ISO 14001 in the United Kingdom. *International Business Management*, 3, 7.
- AMMENBERG, J. and SUNDIN, E. (2005) Products in environmental management systems: drivers, barriers and experiences. *Journal of Cleaner Production*, 13, 405-415.
- BIS. (2010, 09/06/11). "Enterprise Directorate: Small and Medium Enterprise Statistics for the UK and Regions " Retrieved 09/06/11, 2011, from <http://stats.bis.gov.uk/ed/sme/>.
- BRIGGS, S. L. K. (2006) Do Environmental Management Systems Improve Performance? *Quality Progress*, 39, 78.
- BSI (2004) BS EN ISO 14001:2004 Environmental Management Systems Requirements with Guidance for use.
- BSI (2007) BS OHSAS 18001:2007 Occupational health and safety management systems - Requirements. BSI.
- BSI (2008) BS EN ISO 9001:2008 Quality Management Systems Requirements. BSI.
- BURKE, S. and GAUGHRAN, W. F. Intelligent environmental management for SME in manufacturing. *Robotics and Computer-Integrated Manufacturing*, 22, 566-575.
- BURKE, S. and GAUGHRAN, W. F. (2006) Intelligent environmental management for SME in manufacturing. *Robotics and Computer-Integrated Manufacturing*, 22, 566-575.
- CAMPOS, L. M. S. (2012) Environmental management systems (EMS) for small companies: A study in Southern Brazil. *Journal of Cleaner Production*, 32, 141-148.
- CHAPPLE, W., COOKE, A., GALT, V. and PATON, D. (2001) The characteristics and attributes of UK organisations obtaining accreditation to ISO 14001. *Business Strategy & the Environment (John Wiley & Sons, Inc)*, 10, 238-244.
- DELMAS, M. (2001) Stakeholders and competitive advantage: The case of ISO 14001. *Production and Operations Management*, 10, 343.
- DELMAS, M. (2004) Erratum to "Stakeholders and Competitive Advantage: The Case of ISO 14001". *Production and Operations Management*, 13, 398.
- DEPARTMENT FOR BUSINESS INNOVATION & SKILLS. (2010, 09/06/11). "Enterprise Directorate: Small and Medium Enterprise Statistics for the

UK and Regions " Retrieved 09/06/11, 2011, from <http://stats.bis.gov.uk/ed/sme/>.

EUROPEAN UNION (2005) The New SME Definition User Guide and Model Declaration.

FRESNER, J. (2004) Small and medium sized enterprises and experiences with environmental management. *Journal of Cleaner Production*, 12, 545-547.

GREENWOOD, P. E. and NIKULIN, M. S. (1996) *A guide to chi-squared testing (Wiley Series in Probability and Statistics)* New York Wiley and sons

HERAS, I. and ARANA, G. (2010) Alternative models for environmental management in SME: the case of Ekoscan vs. ISO 14001. *Journal of Cleaner Production*, 18, 726-735.

HILLARY, R. (2004) Environmental management systems and the smaller enterprise. *SME and Experiences with Environmental Management Systems*, 12, 561-569.

HILLARY, R. and BURR, P. (2011) Evidence-based Study into the Benefits of EMSs for SME. DEFRA.

PEREZ-SANCHEZ, D., BARTON, J. R. and BOWER, D. (2003) Implementing environmental management in SME. *Corporate Social Responsibility & Environmental Management*.

SROUFE, R. (2003) EFFECTS OF ENVIRONMENTAL MANAGEMENT SYSTEMS ON ENVIRONMENTAL MANAGEMENT PRACTICES AND OPERATIONS. *Production & Operations Management*, 12, 416-431.

VACHON, S. and KLASSEN, R. D. (2008) Environmental management and manufacturing performance: The role of collaboration in the supply chain. *International Journal of Production Economics*, 111, 299-315.

VAN HEMEL, C. and CRAMER, J. (2002) Barriers and stimuli for ecodesign in SME. *Journal of Cleaner Production*, 10, 439-453.

WILLIAMS, H., VAN HOOYDONK, A., DINGLE, P. and ANNANDALE, D. (2000) Developing Tailored Environmental Management Systems for Small Businesses. *Eco-Management & Auditing (Wiley)*, 7, 106-113.

YIN, H. and SCHMEIDLER, P. J. (2009) Why do standardized ISO 14001 environmental management systems lead to heterogeneous environmental outcomes? *Business Strategy & the Environment (John Wiley & Sons, Inc)*, 18, 469-486.

ZORPAS, A. (2010) Environmental management systems as sustainable tools in the way of life for the SME and VSME. *Bioresource technology*, 101, 1544-1557.

ZORPAS, A. A., TSARTAS, P., ARISTIDIS, G. and THEOHAROUS, O. (2008) Mediterranean standard for sustainable tourism (MESST) – general

requirements, objectives and the philosophy of MESST. *Sustainable Tourism, Wessex Institute of Technology*, 3.

5 A Critical Review of Classification of Organisations in Relation to the Voluntary Implementation of Environmental Management Systems

5.1 Introduction

As shown in Chapter 1 there is a need to develop a method for categorisation beyond that of SME and non SME that enables a classification process to best highlight the barriers and motivations for EMS implementation within SME. This Chapter will review existing classification methodologies relevant to environmental management so as to determine if opportunities exist for their practical application in this sector. It begins with an introduction to EMS and existing discussions regarding implementation is provided before a more detailed consideration of organisational size, the integration and development of environmental management within an organisation, then cladistics and QMS are reviewed as potential opportunities for classification. This shows that whilst numerous methods are available, none function beyond the theoretical, or that the classes provided restrain the description of the complex tasks.

Central to differences faced by organisations are insights to the true hurdles that each experience when implementing an EMS. It is shown here how the manipulation of techniques from the more mature field of Energy Management may offer a direction for the development of robust classes. A valuable outcome is that these methods produce classifications that are fit for purpose to better support organisations through the implementation and management of their EMS.

5.2 Evolution of Environmental Management Systems

The need and ability of an organisation to manage and control its impact on the environment has been hotly debated in recent times. However, the uptake of certificated EMS, specifically ISO 14001 (British Standards Institution, 2004), is becoming more prevalent, even though evidence of the individual benefits are less clear. Furthermore, reports are often limited and anecdotal in their discussion of the true barriers that organisations experience during the certification and management of their EMS. Presently organisations are

commonly classified simply according to size and the barriers they experience when implementing an EMS successfully. This system of classification is not sufficient to understand the multifaceted environments within which modern organisations operate.

For any organisation the most important factors for survival are to remain profitable, competitive and to increase market share. However, as organisations become ever more accountable for their social and environmental impact (Porter and Kramer, 2006), they must treat their operational impact on the local and wider environment as a fundamental aspect of policy or strategy design and demonstrate engagement in this through better environmental management (Aiyub et al., 2009).

Considerable, although not uniform, agreement exists that voluntary instruments are both beneficial and have the ability to run concurrently with existing command and control policies (Alberini and Segerson, 2002; Arimura et al., 2008). Darnall (2003) suggests a combination of institutional pressures and internal competencies as explanations for organisations' participation in voluntary environmental programmes, highlighting; regulatory pressure, social pressures, continual improvement capabilities and capital expenditure as motivations for the early adoption of certified EMS.

There has been considerable development of voluntary models for environmental management, those which go beyond legislative requirements and the pressure to undertake their implementation (Delmas and Montiel, 2008). By far the most commonly used, and so discussed, of these instruments are ISO 14001, in the UK, and the Environmental Management and Audit Scheme (EMAS) in Europe, with substantial levels of research attributed to their application (Delmas and Montiel, 2008; Giles, 2008; Hillary, 2004)

5.3 Barriers to Environmental Management Systems

Many authors have discussed the perceived barriers to EMS implementation within organisations, citing; the possibility of negative publicity and uncertainty over future regulatory controls (Delmas, 2000; Hillary, 2004; Fresner, 2004; Yin and Schmeidler, 2009). Additionally, and specifically in smaller organisations; a

lack of the required resources, including both finance and time, lack of rewards and added bureaucracy are stated as barriers to the uptake of EMS (Hillary, 2004). However, such arguments are relatively undeveloped with discussion largely based on anecdotal evidence and small scale case studies with results being used to draw general conclusions across the diverse and multifaceted environments that companies operate within.

Hunt and Auster (1990) highlighted the impact of companies' associations with negative environmental impacts, of which they include loss of competitive advantage, strained relationships with suppliers and vendors, extensive cost and loss of public image. They continue to surmise that a solution to these issues cannot be reached through a 'band aid' approach to environmental management, rather that if true and sustainable benefits are to be made then investment should be made in resource reduction management programmes.

However, even with the growth in legislative and voluntary controls, companies approach this growing challenge with diverse perspectives on the values and benefits of compliance or strategies that move beyond compliance. Companies, often of similar circumstance, vary; from those who support environmentally sound initiatives to those that avoid compliance even with existing legislation (Bansal and Roth, 2000). Paulraj (2009) discusses the need to understand the differing motives for environmental strategies and their correlation with environmental behaviour and how this often is only undertaken through 'organisation level' focus. Therefore, a better understanding is required of the criteria or circumstances that cause companies to display particular behavioural patterns in response to the notion of EMS. Consequently, the ability to be able to comprehensively understand the behaviours of companies in terms of business culture and structure parameters will enable the cultivation of mechanisms that support environmentally sustainable practices and help to avoid the reported barriers faced during their implementation and management within the wider organisation environment.

The chapter investigates opportunities and limitations for the categorisation of organisations. It is argued that this will further understanding of the factors that

influence EMS implementation, as opposed to reiterating existing discussions on EMS. More appropriate categorisation should enable specific motivations and barriers, associated with EMS, to be attributed to applicable organisations. This should allow for more resource efficient promotion, implementation and management of an individual EMS.

5.4 Existing Methods of Organisational Classification

It is proposed that, to better understand the barriers to EMS implementation for the multitude of participants, broader methods of classifying companies should be employed. McKelvey (1978) offers benefits of “General Classification”, as a methodology that groups objects by all their individual attributes, to include: 1) Strengthening of scientific understanding that enables homogeneous groups to be defined and subsequent hypotheses to be tested, 2) The ability to provide more comprehensive information retrieval, 3) Providing a conceptual framework capable of understanding and communicating the intrinsic diversity existing across companies, and 4) Applying classification schemes to other areas of a organisation including behaviour, development and practical management.

However, Goodall’s (1954) paper entitled “Vegetational classification and Vegetational continua”, cited in McCarthy (1995) suggests attempts at classification can result in nothing more than a waste of valuable scientific time, relating the problem to one of confusion through an inadequate understanding of the multiple taxonomical methodologies available as opposed to a fundamental desire to classify. McKelvey (1978) distinguishes taxonomy from classification as a process that not only identifies and assigns characteristics to recognised classes, but also provides a theory for the development of defined differences. Therefore if taxonomical reference is to be made in application to an understanding of the classification of organisations, it is imperative that a clear and unambiguous understanding of the organisational behaviour be achieved. Furthermore, these must incorporate time series studies of specific attributes that encompass the complexities of modern organisational culture.

5.5 Classification through Organisational Size

In an effort to better understand the barriers to EMS implementation, size dependent classes have been proposed. However, the division of organisations is often as basic as SME and non SME (Williams et al., 2000; Koroljova and Voronova, 2007; Heras and Arana, 2010). However, within the UK, the split between SME and non SME is shown to be 99% and 1% of UK private sector organisations respectively (Department for Business Innovation and Skills, 2010).

With 99% of companies within the UK falling within the category of SME, it seems reasonable to assume that, although some similarities may exist between companies within the SME and non-SME classes, there will also be considerable differences and variations within each category in terms of the types of: business activity, organisational culture, resource availability, staff skills and challenges faced. Consequently, different requirements and expectations will be placed on the barriers faced when achieving implementation of an EMS, particularly related to the availability of different staff abilities and skills. The potential ambiguity of results obtained from the application of a limited choice of classes such as SME or non-SME, suggests that a 'one size fits all' option for effective and efficient environmental management, within such broadly defined classes is neither practical nor useful. Consequently, a more discriminating classification of organisations is required to support the diversities of activities, with which each organisation is involved, as well as the skills, qualification and motivation exhibited by the stakeholders investing in environmental management initiatives.

With such a high percentage of UK private sector organisations classified as SME, a correlation between their financial turnovers and environmental impacts might seem inevitable, nevertheless, the complexities and the levels of correlation are still ardently debated (Yin and Schmeidler, 2009; Giles, 2008; Rowland-Jones et al., 2005). It seems reasonable to assume that an industry and commerce category that accounts for 99.8% of all the enterprises in the European Union, 47% of total turnover and 48% of employment would also

account for a substantial percentage of the overall environmental impact of organisations. Pimenova (2004) offered an estimation of the environmental impact attributable to SME as high as 70% of the total. Although, with reference to research undertaken in six European Union countries, Pimenova (2004) concludes that the total is more likely to be in the region of 50% bringing it in line with the relative proportions of turnover and employment of SME. The argument for the initially higher percentage estimation was related to the impacts arising from the externalities of organisations' activities and therefore not included in calculation methodologies (Kenny and Gray, 2009; Carbon Trust, 2008; DECC, 2009). It could also be argued that office floor area usage may be less dense for SME resulting in higher environmental impacts per person in this sector. Zorpas (2010) confirms this confusion, highlighting that the heterogeneous nature of SME makes generalisation about environmental issues very difficult.

Through a more discriminating classification of the sector more specific barriers and motivations might be discerned and understood and therefore more fitting approaches taken in both the marketing and application of EMS. Hillary (2004) highlights the inherent heterogeneity prevalent in a single category as broad as SME thus highlighting a disparity, and possible deficit, in the knowledge required to support the mounting enthusiasm towards sustainability. Hillary (2004) concluded that future research in this field required further sub-division of the category of SME by either; size or by industry sector. However, no explanations for these specific choices of classes are discussed or reasoning for their pre-eminence provided.

Zorpas (2010) expanded on the work of Hillary (2004) by undertaking a detailed analysis of EMS for SME and very small to medium enterprises (VSME), based on the European Union's (2005) SME definition . The research endeavours to distinguish the different needs, wants and stimuli for EMS implementation in SME and the subcategory of VSME. Zorpas (2010) hypothesised that VSME often provided mono-service or product offerings and that they were disproportionately affected, in a negative manner, by economic pressures.

Additionally, it was suggested that the responses of VSME to new requirements of the market were restricted through little access to further training; non participate in knowledge transfer or developing cross organisation federation yet whilst produce high levels of waste (Zorpas et al., 2008). However, contradictory research suggests that SME experience distinct advantages over non-SME when implementing green initiatives including less bureaucracy, quicker response time and efficient internal communication (Van Hemel and Cramer, 2002). This debate highlights the inefficiencies of organisational classes such as size for categorising organisations. If the classes developed are unrepresentative of actual activities the resulting classification will also be unrepresentative of the barriers and benefits experienced by participating organisations.

Separate research within this field has approached the understanding of SME and EMS implementation in terms of its integration within an organisation, by focusing on the motivations driving the process and attempting to offer a classification methodology based on this (Paulraj, 2009; Jabbour and Santos, 2006).

5.6 Classification Based on Stages of Integration, Development and Evolution

Jabbour and Santos (2006) discussed environmental management classification as a taxonomical study that is not size dependent but rather related to the achieving of a “stage” within an evolutionary process dependent on the level to which environmental strategies and actions are integrated within a particular organisation. Jabbour and Santos (2006) summarised this research and propose taxon comprising of three evolutionary stages of environmental management; (i) functional specialisation, (ii) internal integration and (iii) external (or strategic) integration. Jabbour and Santos (2006) suggested that each taxon draws together several criteria for defining the environmental management maturity that may be present within a organisation and proposed that the level of maturity found within organisations ultimately correlates with a organisation’s overall organisational configuration. However, as with the classification of organisations by size (SME, SE and VSE), this taxonomy only

provides three options within which to place all organisations and with very broad criteria for inclusion. It must be questioned whether such broad classes (taxa) would be able to provide sufficiently clear discrimination between participants.

Jabbour and Santos (2006) bases their findings on an investigation of 37 organisations that had achieved certification to ISO 14001, importantly implying that all of these organisations had a degree of understanding and commitment to improvements in environmental management. However, Jabbour and Santos (2006) states that these organisations still demonstrated discrete behaviours, suggesting that these could be attributed to specific organisational contexts. This heterogeneity is a phenomenon that has been neglected in literature and Yin and Schmeidler (2009) state that, due to the '*standardised*' nature of management systems they are often linked with a perception of homogeneity that encourages unrealistic conclusions being drawn as to the similarity of the processes or structures of one organization to those of another (isomorphism). Furthermore, it raises the question as to whether the scope of the conclusions reached by Jabbour and Santos (2006), for companies that have achieved ISO 14001 certification, can be expanded to include companies that have yet to, or have no intention of, acquiring certification to ISO 14001. Including such companies within a limited "evolutionary" matrix may impact on the usefulness of the proposed taxonomy, especially when existing variations in behavioural patterns are taken into account. This implies a need for a wider research base and for a greater number of relevant classes (taxa) to be considered. Paulraj (2009) strengthens this argument through concluding that the research undertaken to date had been modest and based on "*a parsimonious set of motivational indicators*". Therefore, Paulraj (2009) determines that future research is required that not only refines and strengthens the identified constructs, but also expands both the theoretical and empirical bases of future research through the use of additional motivational indicators and a broader set of descriptive variables.

5.7 Classification Through the use of Cladistics

It has been suggested that an organisation's approach to EMS implementation can have a direct impact on the internal development of the scheme (Yin and Schmeidler, 2009) and an overly simplistic classification may ignore the heterogeneous nature of organisations (Hillary, 2004). Therefore a more comprehensive process of defining classes that incorporates behavioural aspects of an organisation should be established in relation to environmental management systems. McKelvey (1978) suggests that systematics have the potential to dramatically improve the understanding of organisations. This is where the complete system is considered in order to understand differences and their relationships with the wider environment. Subsequently, this process can provide a meaningful method of classification. He cites significant similarities between organisations and organisms. Systematics include three main components: (i) taxonomy - the construction of defined organisational distinctions; (ii) evolution - the mapping of the ancestry of biological the distinctions and (iii) classification - the implementation of processes that enable organisational forms to be placed into classes. However, McKelvey (1978) stated that organisational systematics required both numerical taxonomic and phyletic theories of classification, which are explained in detail in McKelvey (1978).

However, McKelvey (1978) also suggests that focusing on only one or two attributes of an organisation may offer high predictive validity but only in relation to the prescribed areas of organisational behaviour, entitling this "Special Classification". Therefore, special classification is only beneficial if the attribute(s) included are the point of focus and offers poor mechanisms for retrieval and understanding of the relationships between wider organisational behaviours. That is to say where a functional study uses taxa based on size it may be difficult to transpose this knowledge to taxa relating to age, bureaucracy or complexity within organisations (McKelvey, 1978).

McCarthy (1995) incorporated the work of McKelvey (1978) to consider the application of the concepts of organisational systematics and biological

taxonomy in an attempt to classify organisations within the manufacturing sector. McCarthy (1995) discusses the notions of numerical, essentialistic, nominalistic and cladistic theories as methodologies for the development of taxa to be used for such classifications. Cladistics, although originating in the classification of languages and then migrating into biological evolutionary theory, has become embedded in attempts to make classifications within the manufacturing sector (Leseure, 2002). Leseure (2002) suggested that cladistics was initially deemed “lowbrow” by evolutionary biologists in comparison to phenetics, a quantitative classification technique based on the use of cluster analysis. Cladistics, a systematisation technique, allows “specimens” to be grouped into systems and because of this “*cladistics can be applied to study the history of any evolving system: the evolution of management ideas, of beliefs, of products, of technologies, etc.*” (Leseure, 2002). McCarthy et al (2000) suggested that cladistics is the dominant approach in biology and therefore the most suitable tool for classification of manufacturing companies. Leseure (2002), supported this conclusion, suggesting that cladistics, rather than phenetics was the most applicable tool within this field.

McCarthy (1995) shows that cladistics, through their wider application, have developed a set of rules and principles. These rules are concerned with operational principles, such as branching and labelling. It is suggested that these rules are transferable to operational principles of other industries and systems, specifically manufacturing. However McCarthy (1995), although offering a dendrogram, does this only in an explanatory context, as opposed to one capable of practical application. McCarthy (1995) concludes that a relatively precise, stable, enduring and universal classification could be achieved and that this would significantly improve understanding of, in this instance, manufacturing organisation systems. Furthermore, McCarthy (1995) considers that this methodology may increase the accuracy and value of predictions which would subsequently bring about ‘ideal’ category specific models and solutions.

However, although the practice of cladistics enables multiple taxa and the resulting expansion of classes beyond those found when using industry size

and type alone, it does have limitations and is not without detractors. The processes have been described as post-hoc with limitations specifically related to future decision making processes or evolutionary trajectories such as the implementation of innovative technologies and advanced systems (Baldwin et al., 2005). In this context, post-hoc analyses are concerned with finding patterns and/or relationships between subgroups of sampled populations that would otherwise remain undetected were the investigators to have to rely strictly upon a-priori statistical methods. Such analyses form a valuable collection of tools which allow exploratory research greater freedom. McCarthy (1995) highlighted that the essential attributes of taxa should be appropriate, with reference in his paper to the manufacturing sector. In this instance the development of taxa had been made in reference to the classification of organisations and considered a number of factors which must be:

- Mutually exclusive - taxa must not allow for a organisation's inclusion in more than one category.
- Internally homogenous - certain discrete behaviour must be excluded during classification.
- Collectively exhaustive - taxa provided must ensure complete inclusion of all participating organisations.
- Stable - further empirical tests of organisations should not affect the predetermined taxa.
- Relevant in terms of naming - to ensure effective communication naming of taxa should be based on common academic and business language (McCarthy, 1995).

Furthermore, Leseure (2002), McCarthy (1995) and McCarthy et al (2000), although providing eloquent arguments supporting the benefits of cladistics, did so from a very fundamental stand point. They do not provide either empirical evidence of application or the methodology used to achieve the conclusions drawn. Furthermore, no empirical evidence was provided to support their theory that classification can aid a decision making process was lacking. The link between theory and practical application of this argument is missing, as is the inclusion of constraints for the construction of robust taxa. It is implied but, not

explicitly explained by the authors, that cladistics can provide a classification system based on an evolutionary process. Additionally, cladistic analysis has been defined, by Lipscomb (1998), as providing “*relative statements of relationship*” rather than being capable of “*explicitly hypothesising ancestor-descendent relationships*” (Lipscomb, 1998).

5.8 Classification Related to the Concepts of Quality Management

A further opportunity to expand the classes used when categorising organisations in relation to their environmental management is their integration with practices more usually discussed within the context of quality management. This link has been keenly discussed in relation to ISO 14001 and the QMS BS ISO 9001 (Zeng et al., 2005; Castka and Balzarova, 2008; Tarí and Molina-Azorín, 2010). Zeng et al (2005) showed that the term integration itself has multiple definitions and that although not necessarily contradictory these terms do focus on specific characteristics that therefore alter the meaning of the word in discrete contexts.

Gavin (1991) focuses on integration in relation to the ability to offer synchronization and unity within an organisation, whereas MacGregor Associates (1996) see integration as a singular, top level, standard capable of supporting modular attachments for specific requirements. This complicates the work of authors such as Jabbour and Santos (2006), who provides a classification process based on ‘*integration*’ to evaluate environmental management and to develop a supporting classification of companies. Furthermore the method’s foundation lies in reviews of existing research, not empirical trials that would suggest an opportunity for practical application. Additionally, due to the very limited classes offered (3) the process does not promote integration as a classification process over other discriminatory behaviours.

This is not to say that environmental management and its integration with quality management cannot support the development of classes that benefit the understanding, and subsequent ability to offer a beneficial service to SME.

Using the requirements of ISO 14001 and ISO 9001 (Annex B of ISO 14001 and Annex A of ISO 9001) (British Standards Institution, 2004; British Standards Institution, 2008), the internationally recognised and extensively adopted EMS and QMS (Zeng et al., 2005) highlight that opportunities for integration are clear with every specific requirement of ISO 14001 having a direct link to the similar requirements within ISO 9001.

This review of ISO 14001 Annex B (British Standards Institution, 2004) also highlights another simplification in the available classes and may go some way to explain the discrete behaviours shown by companies attempting to attain certification. Within most of the relevant literature, ISO 14001 is discussed as a single standard and not in terms of its multiple requirements to which organisations must comply for certified compliance (Hillary, 2004; Zorpas, 2010; Giles, 2008; Yin and Schmeidler, 2009). It has been clearly shown that different organisations approach ISO 14001 implementation and management differently (Yin and Schmeidler, 2009; Hillary, 2004; Fresner, 2004), therefore it can be concluded that organisations will approach and integrate individual challenges discretely too. Consequently a more comprehensive classification methodology might be able to incorporate these behavioural attributes more readily.

5.9 Future Opportunities for Classification

Lessons in classification may also be learnt through the investigation of energy management, a longer studied and more mature research field that offers considerable similarities with the current interests in environmental management. The use of ISO standards in applicable disciplines clearly shows a significant link in the requirements of both energy and environmental management (British Standards Institution, 2011). It may then be concluded that lessons already learnt in the field of energy management may be both applicable and beneficial in avoiding wasted effort through the “reinvention of the wheel”, in research into the uptake of EMS.

Instead of attempting to channel organisations and their discrete attributes into pre-determined and confining classes reliant on perceived similarities, a more logical process would be to develop an understanding of both the similarities

and differences present. Fawkes (1978) proposed aspects of organisation structure, resource base and character that potentially allow a move away from a limited approach to classification by offering the “Seven S Approach”. In this approach he considered the description of organisation and culture in terms of 7 classes as follows:

- *Superordinate goals*: the guiding concepts instilled by an organisation in its members.
- *Strategy*: the process by which an organisation allocates its finite resources to achieve desired outcomes.
- *Structure*: the characteristics of the organisation’s structure.
- *Systems*: proceduralised processes.
- *Skills*: possessed by either individuals, groups or the organisation as a whole.
- *Style*: the behaviour and characteristics of key managers in the implementation of organisational goals as well as the organisational culture.
- *Staff*: the breakdown of significant employee classes (Fawkes, 1987).

Although the seven S’s concept was intended to allow behaviours of companies to be differentiated, this methodology also provides an opportunity to categorise aspects of organisational behaviour. An example of this is provided when Western and Japanese management styles are compared and their differences highlighted using the seven S factors (Pascale and Athos, 1982). This work provides a set of classes that allow discrete behavioural patterns to be identified. The Seven S system will allow the inclusion of the previously discussed classification methods (Figure 11), to develop a methodology for studying the behaviours of organisations in relation to environmental, energy or quality management requirements.

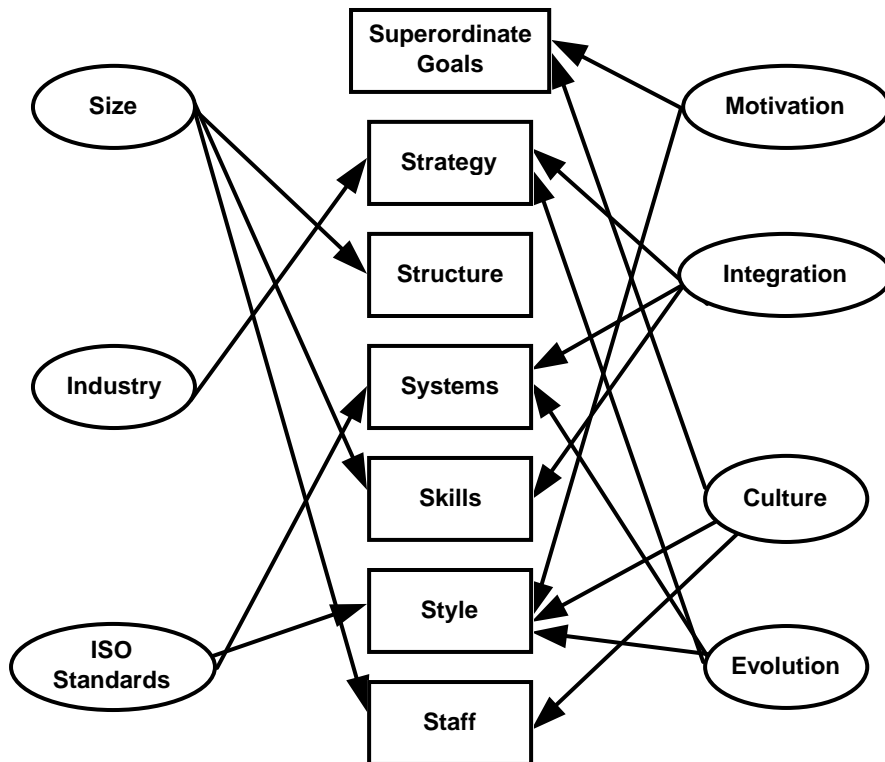


Figure 11: The Seven S Model and the Correlation with Discussed Categories

To move from providing the theoretical basis for research to the development of a practical methodology, the Seven S model requires a structured platform to enable its application. Existing techniques from the energy sector may be able to provide this structure in the form of the well established notion of the Energy Management Matrix (BRECSU). This tool, in its original guise, acted as an effective method of increasing the understanding of a organisation's energy management philosophy and practice (Ashford, 1993).

The matrix's columns deal, individually, with areas pertinent to energy management and the rows offer qualitative descriptions of increasingly sophisticated controls for these. The use of this matrix suggests that through the application of Fawkes (1978) model it may be possible to bridge the existing gap between a theoretical basis for classification and a practical methodology.

5.10 Discussion

Research surrounding EMS and its impact on companies is extensive and clearly highlights a growing pressure on them to incorporate green controls

within their operational procedures. The evidence that individual organisations approach and experience EMS implementation and management differently remains mostly anecdotal and has been derived from research where these aspects were of secondary concern to the purpose of the studies.

Additionally, reported notions concerned with methods of classification, particularly in relation to EMS appear to be either convoluted or overly simplistic in terms of the taxa proposed. Proposed approaches focus on only a small aspect of organisation behaviours in response to environmental management and so require companies to be 'shoe horned' into classes that subsequently are unable to allow the discreet behaviours they may exhibit to be distinguished. Rather existing research, including that of Hillary (2004), Koroljova and Voronova (2007), Heras and Arana (2010) and Yin and Schmeidler (2009), highlights the need to better understand the heterogeneity inherent within smaller enterprises and the need to understand these in terms of barriers to EMS implementation. However to date, research has not provided either encompassing sets of classes or proposed methods capable of converting theory into applicable methods from which conclusions might be drawn.

Previous research has discussed the reasoning for EMS implementation in terms of motivations driving the process, even attempting to categorise organisations by this (Paulraj, 2009; Jabbour and Santos, 2006). However, the need for research to encompass the requirements of differing organisations and their wish to achieve different outcomes beyond simple compliance to an EMS has mostly been neglected. Various aspects of ISO 14001 are likely to be given different weightings by companies and so resources will be allocated accordingly. This important aspect of organisational behaviour has not been factored into any of the classification methodologies proposed to date.

Confusion is compounded by the seemingly interchangeable terms classification and taxonomy. If research does not encompass detailed information surrounding organisational evolution and behaviour and is not based on time series studies it is unable to provide taxa. Consequently the term classification is more accurate when discussing existing research.

Potential exists for research into the implementation of EMS to learn from more established areas such as energy management. Concepts such as the seven S model and energy management matrices may enable more appropriate and discriminating classes to be defined that offer meaningful and applicable methods of classification. To further research in this field a comprehensive and structured understanding of the discrete behaviours exhibited by companies is required to support the development of a more extensive set of classes. It is proposed that robust classes may be identified that encompass and integrate multiple parameters of service based systems and that these should be used (rather than restrictive sets of classes drawn from a limited view of the field of study). It is also necessary to incorporate the diversity prevalent in organisations that may presently portray similar characteristics when existing taxa are employed and (with particular reference to EMS) allow for the different motivations for pursuing certification.

For some of the more complex methods of classification there has been a lack of practical application. Cladistics, although developed from a sound academic base, has yet to be proven in the context of environmental management. Furthermore, the variety of research combined with the lack of application has lead to a diverse group of methodologies that, in turn, create confusion for future research or application and a fundamentally limited understanding of the notion of taxonomy.

To overcome this hurdle it is proposed that consideration is given to research previously carried out under the title of “Energy Management”. Energy management, being extensively developed since the late 1970s, offers transferable knowledge, techniques and skills. It has also been shown that there are considerable similarities between a number of standards including quality, energy and environmental management standards BS EN ISO 50001:2011, ISO 9001 and ISO 14001 respectively. As such it may be possible to apply lessons learnt in the context of any one of these standards to organisations that operate certification to the other standards.

Furthermore, Fawkes' (1987) notion of seven classes within which companies may be described when incorporated with attributes such as size and activity type provides a basis for a method of developing taxa that will enable an understanding of both the similarities and differences present in organisation behaviours as related to certification and application of EMS. Through the use of the proposed model it may be possible to bridge the existing gap between a theoretical basis for classification and a practical methodology.

5.11 Conclusions

It can be seen that there are significant gaps in our current understanding of the heterogeneity of organisational responses to EMS implementation. Discussion to date has often been based on opinion and anecdote as opposed to evidence. Furthermore, it is clear that there is a requirement for a robust process of categorisation that incorporates behavioural, as opposed to standard metrics for organisations. Such an approach would inform EMS implementation where understanding of the internal process can then be achieved. The key conclusions of this work are:

- An inherent lack of understanding exists regarding the true barriers to the practises involved in the certification and implementation of an EMS
- The division of organisations is often as simple as Small to Medium Sized Enterprises" (SME) and non SME and this does not support the improvement of the certification process
- No clear basis exists currently for the development of relevant classification processes.
- The process of classification is often confused through the use of multiple methodologies and a limited understanding of the notion of taxonomy.
- The placing of organisations in to groups based upon very broad criteria does not necessarily provide clear discrimination between participants.
- Classification methods such as cladistics, although developed from sound academic bases, are yet to prove their value for practical application in relation to EMS.

- Existing methods of classification neglect to encompass the different requirements of organisations and their wish to achieve different outcomes beyond simple compliance to an EMS
- The 7S model potentially provides a basis for developing taxa that better support the understanding of both the similarities and differences present in organisation behaviours as related to certification and application of EMS.
- It is suggested that the 7S model for organisation organisational behaviours will help to bridge the existing gap between the theoretical basis for classification and a practical methodology.

References

- AIYUB, K., JAH, J. M., ARIFIN, K. and AWANG, A. (2009) Environmental performance in small and medium sized enterprises (SME) certified to ISO 14001 in the United Kingdom. *International Business Management*, 3, 7.
- ALBERINI, A. and SEGERSON, K. (2002) Assessing Voluntary Programs to Improve Environmental Quality.
- ARIMURA, T. H., HIBIKI, A. and KATAYAMA, H. (2008) Is a voluntary approach an effective environmental policy instrument?: A case for environmental management systems. *Journal of Environmental Economics and Management*, 55, 281-295.
- ASHFORD, C. J. (1993) Energy Efficiency: A Managed Resource. *Facilities*, 11, 24 - 27.
- BALDWIN, J., ALLEN, P. M., RIDGWAY, K. and WINDER, B. (2005) Evolutionary systems: Modelling organisational innovation, Innovation. *Innovation: Management, Policy & Practice*, 7, 389-401.
- BANSAL, P. and ROTH, K. (2000) Why Companies Go Green: A Model of Ecological Responsiveness. *The Academy of Management Journal*, 43, 19.
- BRADY, J. (2005) *Environmental Management in Organizations The iema Handbook*, Bath, Earthscan.
- BRITISH STANDARDS INSTITUTION (2004) BS EN ISO 14001:2004 Environmental Management Systems Requirements with Guidance for use.
- BRITISH STANDARDS INSTITUTION (2008) BS EN ISO 9001:2008 Quality Management Systems Requirements. BSI.
- BRITISH STANDARDS INSTITUTION (2011) BS ISO 50001:2011 Energy Management System BSI Standards Publication
- CARBON TRUST (2008) Carbon Footprinting: An Introduction for Orginsations. Carbon Trust.

CASTKA, P. and BALZAROVA, M. A. (2008) The impact of ISO 9000 and ISO 14000 on standardisation of social responsibility--an inside perspective. *International Journal of Production Economics*, 113, 74-87.

DECC (2009) UK's National Strategy for Climate and Energy: Transition to a low Carbon Society. IN CHANGE, D. O. E. A. C. (Ed.).

DELMAS, M. (2000) barriers and incentives to the adoption of ISO 14001 in the United States. *uke Environmental Law and Policy Forum Fall*, 1, 38.

DELMAS, M. and MONTIEL, I. (2008) The Diffusion of Voluntary International Management Standards: Responsible Care, ISO 9000, and ISO 14001 in the Chemical Industry. *Policy Studies Journal*, 36, No. 1, 65-93.

DELMAS, M. and TOFFEL, M. (2008) Organizational responses to environmental demands: opening the black box. *Strategic Management Journal*, 29, 1027-1055.

DEPARTMENT FOR BUSINESS INNOVATION AND SKILLS. (2010, 09/06/11). "Enterprise Directorate: Small and Medium Enterprise Statistics for the UK and Regions " Retrieved 09/06/11, 2011, from <http://stats.bis.gov.uk/ed/sme/>.

EUROPEAN COMMISSION (2005) The new SME definition User guide and model declaration.

FAWKES, S. D. (1987) The seven S approach to energy management. *Applied Energy*, 28, 235-242.

FRESNER, J. (2004) Small and medium sized enterprises and experiences with environmental management. *Journal of Cleaner Production*, 12, 545-547.

GILES, F. (2008) Assessing the effectiveness of your environmental management system. *Environmental Quality Management*, 18, 1-6.

HERAS, I. and ARANA, G. (2010) Alternative models for environmental management in SME: the case of Ekoscan vs. ISO 14001. *Journal of Cleaner Production*, 18, 726-735.

HILLARY, R. (2004) Environmental management systems and the smaller enterprise. *SME and Experiences with Environmental Management Systems*, 12, 561-569.

JABBOUR, C. J. C. and SANTOS, F. C. A. (2006) The evolution of environmental management within organizations: Toward a common taxonomy. *Environmental Quality Management*, 16, 43-59.

KENNY, T. and GRAY, N. F. (2009) Comparative performance of six carbon footprint models for use in Ireland. *Environmental Impact Assessment Review*.

KOROLJOVA, A. and VORONOVA, V. (2007) Eco-mapping as a basis for environmental management systems integration at small and medium enterprises. *Management of Environmental Quality: An International Journal*, 18, 542-555.

LESEURE, M. J. (2002) Cladistics as historiography: part I – introduction to cladistics. *Management Decision*, 40, 486-496.

MCCARTHY (1995) Manufacturing classification: Lessons from organizational systematics and biological taxonomy. *Integrated Manufacturing Systems*, 6, 37-48.

PASCALE, R. T. and ATHOS, A. G. (1982) *The Art of Japanese Management*, London, Penguin.

PAULRAJ, A. (2009) Environmental motivations: a classification scheme and its impact on environmental strategies and practices. *Business Strategy & the Environment (John Wiley & Sons, Inc)*, 18, 453-468.

PIMENOVA, P. and VORST, V. D. R. (2004) The role of support programmes and policies in improving SMEs environmental performance in developed and transition economies. *SME's and Experiences with Environmental Management Systems*, 12, 549-559.

PORTER, M. E. and KRAMER, M. R. (2006) Strategy & Society: The Link Between Competitive Advantage and Corporate Social Responsibility. *Harvard Business Review*, 84, 78-92.

ROWLAND-JONES, R., PRYDE, M. and CRESSER, M. (2005) An evaluation of current environmental management systems as indicators of environmental performance. *Management of Environmental Quality*, 16, 211.

STEVENS, P. A., BATTY, W. J., LONGHURST, P. J. and DREW, G. H. (2012) A critical review of classification of organisations in relation to the voluntary implementation of environmental management systems. *Journal of environmental management*, 113, 206-212.

TARÍ, J. J. and MOLINA-AZORÍN, J. F. (2010) Integration of quality management and environmental management systems similarities and the role of the EFQM model. *TQM Journal*, 22, 687-701.

VAN HEMEL, C. and CRAMER, J. (2002) Barriers and stimuli for ecodesign in SME. *Journal of Cleaner Production*, 10, 439-453.

WILLIAMS, H., VAN HOOYDONK, A., DINGLE, P. and ANNANDALE, D. (2000) Developing Tailored Environmental Management Systems for Small Businesses. *Eco-Management & Auditing (Wiley)*, 7, 106-113.

YIN, H. and SCHMEIDLER, P. J. (2009) Why do standardized ISO 14001 environmental management systems lead to heterogeneous environmental outcomes? *Business Strategy & the Environment (John Wiley & Sons, Inc)*, 18, 469-486.

ZENG, S. X., TIAN, P. and SHI, J. J. (2005) Implementing integration of ISO 9001 and ISO 14001 for construction. *Managerial Auditing Journal*, 20, 394-407.

ZIEGLER, A. and NOGAREDA, J. S. (2009) Environmental management systems and technological environmental innovations: Exploring the causal relationship. *Research Policy*, 38, 885-893.

ZORPAS, A. (2010) Environmental management systems as sustainable tools in the way of life for the SME and VSME. *Bioresource technology*, 101, 1544-1557.

ZORPAS, A. A., TSARTAS, P., ARISTIDIS, G. and THEOHAROUS, O. (2008) Mediterranean standard for sustainable tourism (MESST) – general requirements, objectives and the philosophy of MESST. *Sustainable Tourism*, Wessex Institute of Technology, 3.

6 Method for Primary Research into ISO 14001 and the Analysis and Representation of Data Collected

6.1 Introduction

Chapter 2 has shown that classifying an organisation based on physical attributes such as size and type may offer a cursory approach to categorisation but is unable to fully expose the true underlying factors that affect successful ISO 14001 implementation. Chapter 3 showed the heterogeneity in the occurrence of non-conformities for specific clauses of ISO 14001 (British Standards Institution, 2004) arising during the accreditation process.

Furthermore, it has been shown that:

- There is an inherent lack of understanding regarding the true barriers and motivations for achieving ISO 14001 certification.
- Existing methods of classification do not take into account the different requirements of organisations in relation to their ISO 14001 certification, beyond those of simple compliance.
- Existing theory is often based on small scale and anecdotal research (Stevens et al., 2012).

Further research is therefore required to develop more comprehensive methods of organisational categorisation if meaningful patterns in the barriers to implementation of EMS are to be understood. Through this undertaking it is proposed that more resource efficient approaches to EMS auditing implementation can be developed.

To achieve a greater understanding of the barriers and motivations to the adoption of ISO 14001 and allow more comprehensive categorisation of participating organisations, the opinion of those who undertake ISO 14001 certification was required. Therefore, it was proposed that a questionnaire with a design fit for this purpose would be sent to the organisations in the SGS database of Nonconformities raised against ISO 14001 utilised in chapter 3. The work of Juniper (2009) provided a suitable methodology for the questionnaire design which incorporated both the collection of relevant

quantitative and qualitative data, but also provided a mechanism for the application of statistical techniques designed to bring to light patterns in the data that otherwise might not be easily discerned.

6.1.1 Method for Primary Research into ISO 14001

The work of Juniper (2009), although in itself a comparison of factor analysis and impact analysis, offered a peer reviewed questionnaire design method that offered a comprehensive question design process and allowed the measurement of intangible attitudes, in this instance employee wellbeing. It was this ability to create tangible data about behaviour from opinion and belief that fitted the required research criteria. A synopsis of the process undertaken by Juniper (2009) consisted of:

- A comprehensive list of possible work related problems was generated and, through 15 interviews with employees and five human resources and occupational health professionals, 106 potential variables agreed for use in the study.
- 126 employees were asked to indicate which of the 106 variables they thought were most applicable using a Likert-type 5 point scale (1 = not at all important through to 5 = extremely important)
- Variables were ranked according to impact score with those expressing similar results either combined or with the lower scoring variable eliminated.
- Variables were subjected to a further process of elimination utilising factor analysis which included those with a principle component value less than 0.7 being eliminated
- The remaining variables went into the Varimax rotation (squared correlations between variables and factors) which suggested an eight factor solution accounting for 63% of the variance in the data.

Due to the nature and availability of resources, including access to industry professional consultation with applicable organisations, the method of Juniper (2009) required some modification for this application and so the following process was adopted for this research:

- A list of 93 potential questions relating to beliefs and opinions surrounding ISO 14001 was generated through both; (i) the information derived from the detailed literature review - chapter 1 and (ii) the analysis of ISO 14001 nonconformities - Chapter 3. For reference a full list of the 93 questions please see the “93 Potential Questions” file on the CD attached to this research project.
- Questions were subdivided to fit within the organisational categories listed in Fawkes’ (1987) model for organisational categorisation in relation to energy management, a process utilised by Stevens et al (2012)
- A series of SGS seminars was attended as an opportunity to seek assistance in developing the questionnaire from both SGS auditors and external consultants that support multiple organisations in the implementation and management of their ISO 14001 system.
- The list of potential questions was sent to those auditors and consultants who agreed to be involved. Nine consultants and two auditors returned completed initial responses to the proposed list of questions for potential inclusion in the final questionnaire. Referencing the method of Juniper (2011) the opinion of the respondent on both the relevance and clarity was sought for each question using the Likert-type 5 point scale (1 = not at all relevant/clear through to 5 = extremely relevant/clear).
- The median score, for both clarity and relevance, was calculated and those questions averaging <3 on the Likert-type 5 point scale for either clarity or relevance were eliminated. Questions scoring 5 for relevance were automatically accepted, although still requiring to be reviewed for clarity no matter the relevance score. Those scoring ≥3 and <5 were submitted for review.
- The review process involved two meetings with experts from SGS, the international accredited certification body who provided the database for this research and the research team from Cranfield University. Individual questions scoring ≥3 and <5 for either clarity or

relevance were either combined or those displaying the lower scoring variable eliminated. Questions scoring 5 for relevance were reviewed for clarity alone with the opinions of the technical experts and questionnaire respondents taken into account regarding potential inclusion or the need for the question to be re-written.

- The review process also agreed the format of individual question to ensure factor analysis techniques employed by Juniper (2009) could be replicated across all of the seven categories of questions and that there would be sufficient questions for comprehensive comparisons to be made as well as more detailed qualitative data.
- 44 questions were chosen for inclusion in the final questionnaire to ensure that each of the seven categories were significantly represented. For reference the final questionnaire are available as Appendix B.
- The questionnaire was formatted by SGS both in terms of their branding and to allow compatibility with Zoomerang, the internet based questionnaire software that would be used as the method of communication
- The questionnaire was sent to all of SGS's ISO 14001 clients (circa 850) and 88 responses were returned.
- Factor analysis as well as graphical representation was utilised to expose any observable or overtly indiscernible patterns in the data.

6.1.2 Questionnaire Bias

To ensure the data collected was as accurate as possible it was essential to mitigate potential bias from the questionnaire design. The work of Pak and Chi (2005) identifies 48 potential types of bias and provide examples on how to mitigate against them within the area of public health questionnaires. These factors were taken into account throughout the design and review stages of the questionnaire. Of particular concern was the potential for 'self-selection bias' as the questionnaire respondents will be self chosen as opposed to a random sample. Due to confidentiality agreements between SGS and their clients it was

not possible to randomly approach potential respondents. Sub sampling does not offer a potential solution in this instance as to impose categories would directly contradict the research purpose, to better understand the potential opportunities for categorisation. Therefore, this issue can only be partially mitigated through sample size, quantity of questions and their format.

6.2 Analysis and Representation of Data Collected

6.2.1 Factor Analysis

The data was initially subjected to factor analysis to extract any unobservable, not immediately obvious, patterns present in the data set. Although the questionnaire contained 44 questions, 18 were formatted using the Likert-type 5 scale and could, therefore, be used for exploratory factor analysis, Figure 12 provides an example of a question used in the questionnaire.

The goals of the organisation are clearly communicated to all employees:					
	Strongly Disagree	Disagree	Neither Agree nor Disagree	A g r e e	Strongly Agree
Enter an answer	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5

Figure 12: Example of Likert-type 5 scale question

Responses to these 18 questions were tabulated with rows listing each questionnaire respondent and columns representing the 18 questions. Factor analysis carried out horizontally for individual questionnaire respondents enabled the 18 columns of questions to be reduced to six columns of factors whilst still explaining 77% of the variation in the data. Four of the factors were seen to explain 69% of the variation in the data while the remaining two factors combined explained less than 10%. Factors five and six were subsequently eliminated. The composition and implications of the four remaining factors will be discussed in detail in Chapter 6 Results. This process is explained further later in this chapter. The four factors were then plotted on a scatter plot graph, factor 1 against factor 2 and factor 3 against factor 4. As patterns of relationships between factors were being sought in the individual presentation of each factor was irrelevant.

Once the factors were plotted it was then possible to colour code individual plots dependant on responses to the remaining 26 questions. This process allowed the probability (p) of the patterns observed in the resulting graphs occurring by chance to be assessed on a scale between zero and one. The number that is calculated as result of this process is called the p value. A p value of 0.05 or below, or a confidence level above 95%, indicated a rejection of the null hypothesis, that no relationship exists between the response given in each question and the factors (Greenwood and Nikulin, 1996). An example of a statistically significant test can be seen in Figure 13. In this instance the individual plots of the scatter plot were labelled according to the response provided for question 20e: 'Do you feel the performance of your EMS has improved other aspects of performance in relation to waste'?

As highlighted by a black circle in Figure 13, the factor scores that most influence the relevant factor, i.e. those with the highest value, are colour coded by the response given to the question being tested. Therefore, the question response that most influences each factor can be observed. Figure 13 show that it is a 'yes' response to questions 20e that most influences factor four.

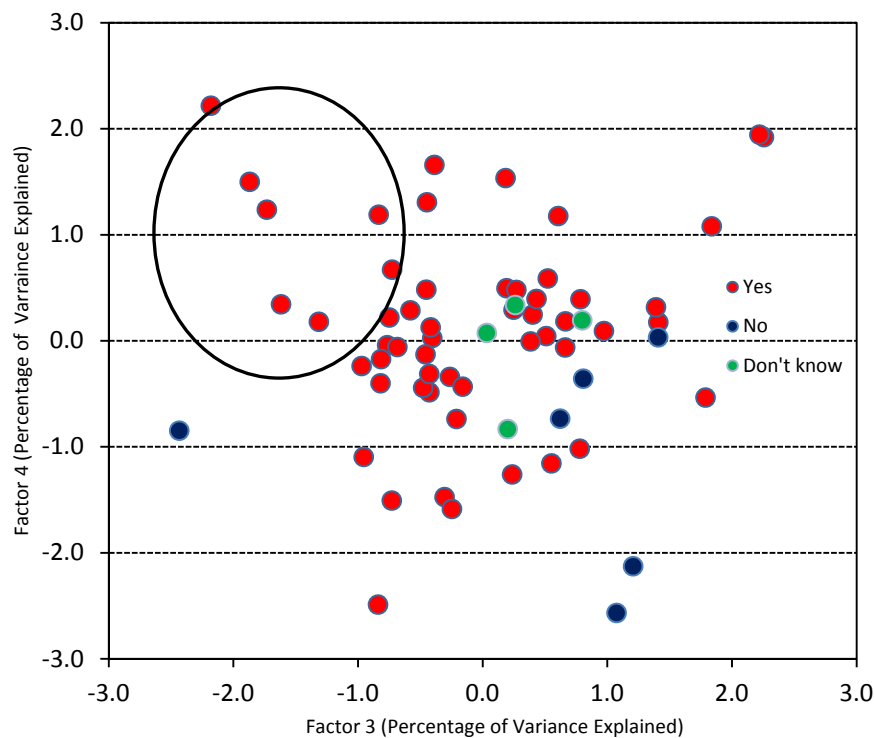


Figure 13: Scatter Plot of Factors 3 and 4 labelled by Question 20e

Ref: Appendix C Figure C 15

The second stage of the factor analysis involved normalising the raw factors through a Varimax rotation. The outcome of these processes is that questions, as opposed to questionnaire responses, become the variables listed in the first column. Next the principal components, relevant to each factor, could be extracted. Initially a principal component was included when the factor score was greater than 0.5 (Juniper et al., 2009). However, it was shown that this value reduced the number of questions to 35 whilst explaining 62% of the variation in the data across six factors and 44% across four factors. A second test was carried out with only factors scores greater than 0.7 constituting inclusion of a principal component. This was seen to reduce the number of relevant questions to 16 whilst explaining 69% of the variation in the data with only four factors. Once the relevant variables had been reduced to 16 in number, it was possible to assess similarities between the questions having the greatest impact on the individual factors and group these where applicable.

Figure 14 provides a scatter plot of factor one against factor two with the influential topics related to each factor plotted.

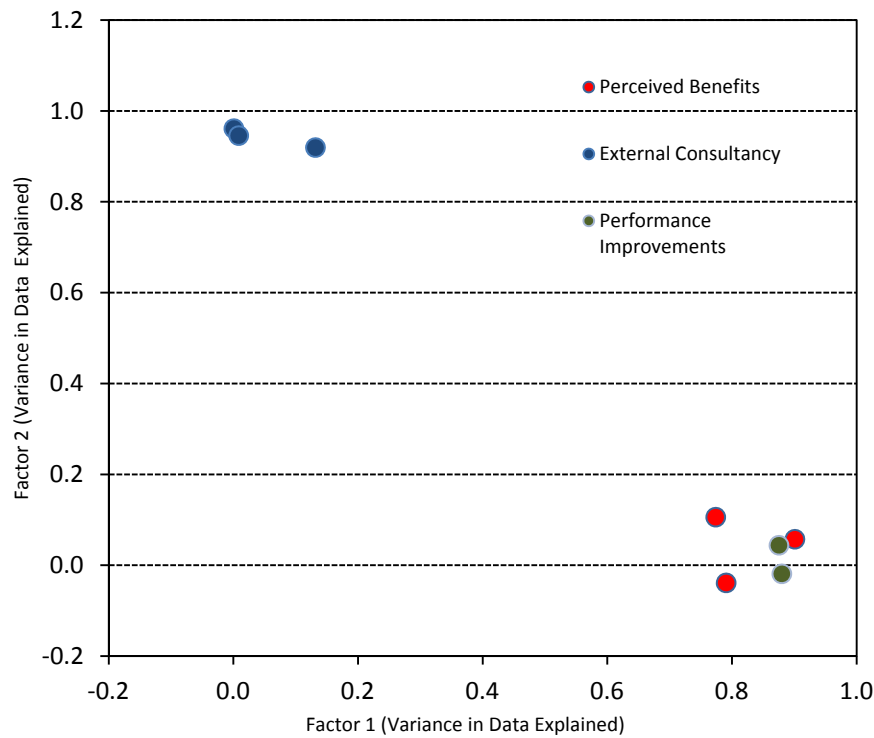


Figure 14: Factor 1 and 2 Groupings of Questions where the Principle Component was Greater than 0.7

Ref: Appendix C Figure C 1

6.3 Basic graphical representation

As a process to better understand and explain the potential patterns expressed thought the factor analysis the data was presented in the form of histograms. This process, although not incorporated in the method of Juniper (2009), provided an opportunity to better understand what motivated companies to implement standards and what areas of these standards different companies found most difficult.

Figure 15 provides represents a Likert-type 5 scale question. In this format respondents were asked to state to what level they agreed or disagree with single statement for one question.

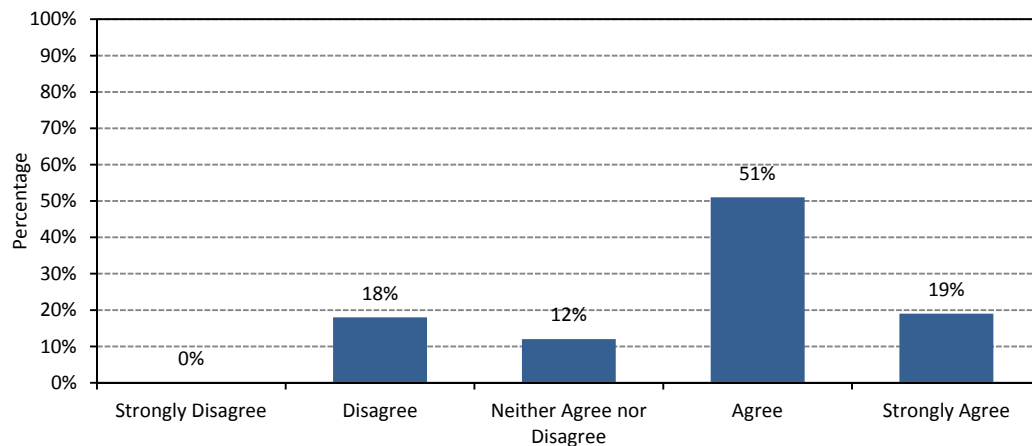


Figure 15: Question 9: Responses to the statement: Our organisation integrates its policy and procedures for multiple standards.

Ref: Appendix D Figure D 9

Figure 16 represents a question that asked for respondent's agreement or disagreement with multiple statements as part of one question. The graph shows the percentage of respondents answering either 'agree' or 'strongly agree' to each individual statement.

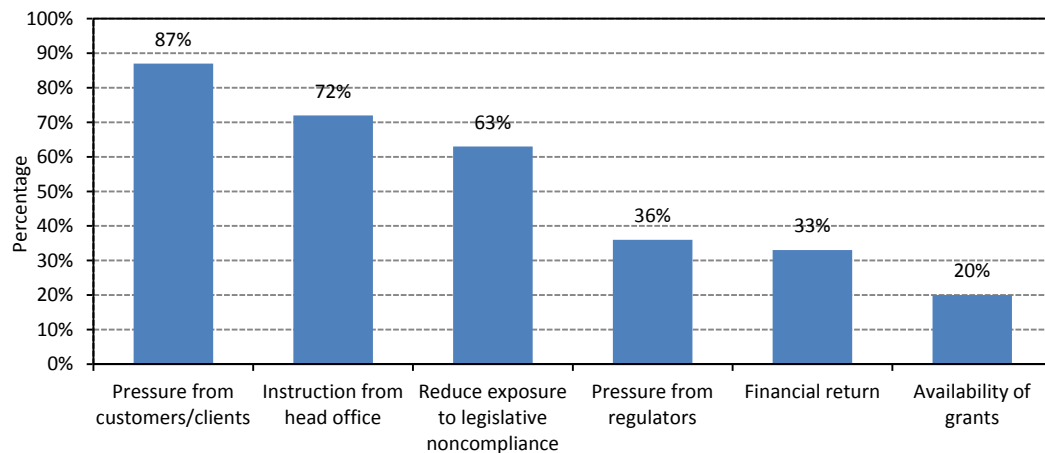


Figure 16: Question 3: The percentage of people responding “Agree or strongly agree” to the question: To what extent did each of the following drivers influence your decision to implement ISO 14001?

Ref: Appendix D Figure D 3

6.3.1 Qualitative responses

Certain questions also asked respondents to provide qualitative data to support the answer given to a question. The purpose of this was to better understand the drivers for the responses given and respondents' interpretation of the question.

The examples below are qualitative responses given to the statement “The goals of the organisation are clearly communicated to all employees” and show that there are not only disparities in responses but also in the mechanisms used for communication.

- 2.1 Could be pushed forward more
- 2.2 There is no mission statement for the UK region but the US region does have one
- 2.3 This is only because the internal sustainability team is so proactive. The communication comes from them, not the Senior Management.

- 2.4 Difficult as 80% are field based
- 2.5 We publish our CR goals to the public and these are also made available to our staff.
- 2.6 All available on organisation intranet site. Cannot guarantee that everyone reads it
- 2.7 Communicated through Environmental Policy, Environmental Manual, and monthly Employee Briefs
- 2.8 Regular organisation updates via monthly enclosures and newsletter
- 2.9 Via Employee Road shows; Our Vision, Our Values, Our Way; and our medium term goals in the categories of customer; competitiveness; people, environment; and communities.

6.4 Method Objectives

The outcome of the chosen method will:

- Provide data related to the motivations to implement and maintain certification to ISO 14001.
- Further understanding of the perceived barriers to ISO 14001 implementation and maintenance.
- Examine the heterogeneity in opinion related to the integration of individual standards
- Better understand the heterogeneity of occurrence of nonconformities arising from the accreditation process across different clauses of ISO 14001 discussed in chapter four.
- Examine questions that promoted the widest distribution in response and their relationship with other questions asked as part of the questionnaire.
- Use the documented diversity in opinion as a means to further development of a method of categorisation.

References

- BRITISH STANDARDS INSTITUTION (2004) BS EN ISO 14001:2004 Environmental Management Systems Requirements with Guidance for use.
- FAWKES, S. D. (1987) The seven S approach to energy management. *Applied Energy*, 28, 235-242.
- GREENWOOD, P. E. and NIKULIN, M. S. (1996) *A guide to chi-squared testing (Wiley Series in Probability and Statistics)* New York Wiley and sons
- JUNIPER, B., WHITE, N. and BELLAMY, P. (2009) Assessing employee wellbeing: is there another way? *International Journal of Workplace Health Management*, 2, 220-230.
- PAK, A. W. P. and CHOI, B. C. K. (2005) A Catalog of Biases in Questionnaires. *Preventing Chronic Disease*, 2, 13.
- STEVENS, P. A., BATTY, W. J., LONGHURST, P. J. and DREW, G. H. (2012) A critical review of classification of organisations in relation to the voluntary implementation of environmental management systems. *Journal of environmental management*, 113, 206-212.

7 Results

7.1 Introduction

Chapter 5 outlined the method used to investigate the data collected from the questionnaire sent to the SGS clients certified to ISO 14001. This chapter sets out to provide a synopsis of the results and provides, where applicable, examples of the graphical data that support them. The complete list of results can be found in Appendix C Results of Statistical Analysis and Appendix D. Graphical Representation of Results. The full sets of statistical test undertaken for the analysis are available on the accompanying CD.

As described in Chapter 5, the method adopted to draw information from the data involved the establishment of four factors, created from 18 applicable questions, for each questionnaire response. These factors' are described in Table 10. The factors scores were plotted on scatter plot graphs with individual plots colour-coded dependent on responses to the remaining 26 questions. Furthermore; organisational size, organisational type and stage of certification to ISO 14001 of respondents' organisations was also plotted. This was undertaken as an opportunity to directly compare categorisation methods used in other studies (Hillary and Burr, 2011; Zorpas, 2010) with the potential ones derived from the questionnaire.

7.2 Synopsis of Results

Figure 17 and Figure 18 represent the factor analysis scores of individual questionnaire responses displayed on scatter plot graphs with the individual plots labelled using the known size of the organisation, in this instance SME or Non SME. This test has been repeated applying both organisational type, i.e. service or manufacturing and stage of certification process. In none of these tests was the probability of the result observed assessed to be significant, that is to say the p value was shown to be above 0.05. This result led to the null hypothesis, that no relationship exists between the response given to a question and the factors scores, not being rejected (Greenwood and Nikulin, 1996). The p values recorded for this test are documented in Appendix C Table C3. For

reference the complete test results are provided in the accompanying CD to this research.

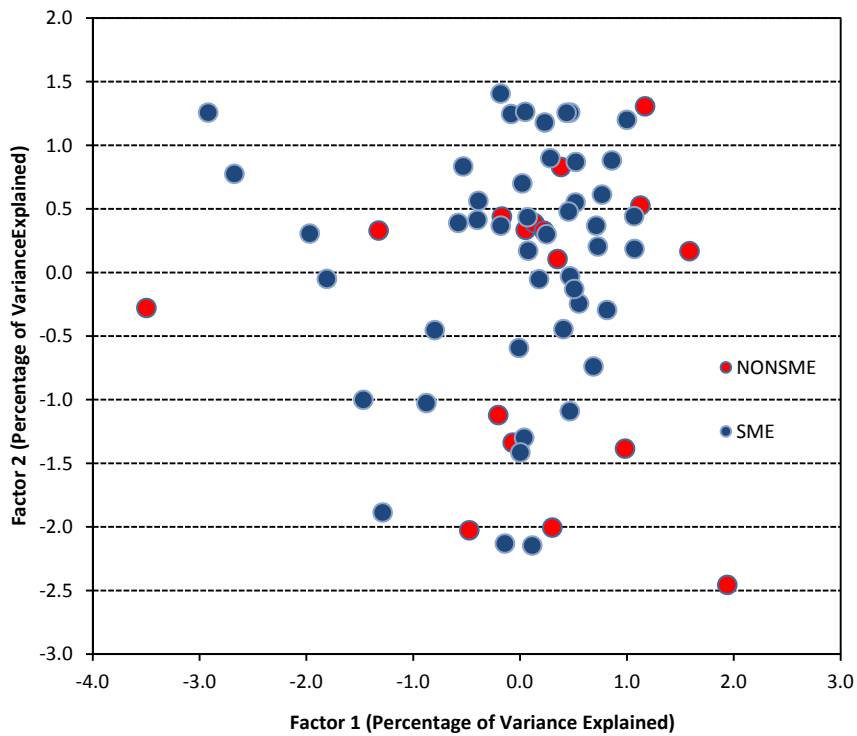


Figure 17: Scatter Plot of Factors 1 and 2 Classified by Organisational Size

Ref: Appendix C Figure C 3

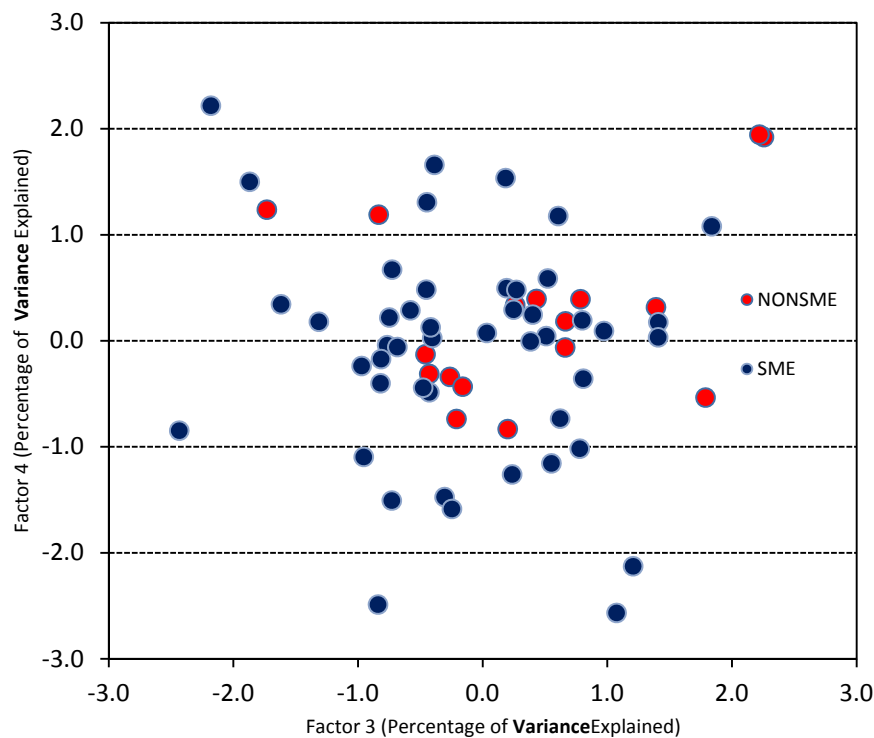


Figure 18: Scatter Plot of Factors 3 and 4 Classified by Organisational Size

Ref: Appendix C Figure C 4

Figure 19 represents the factor analysis scores for factor one and two colour coded by the response given to question 20a: Do you feel the performance of your EMS has improved other aspects of performance in relation to business development. Figure 20 represents the factor analysis scores for factors three and four colour coded by the response given to question 20e: Do you feel the performance of your EMS has improved other aspects of performance in relation to waste. For question 20a and 20e a p value below 0.05 was recorded, $p=0.0000163$ and $p=0.0165523$ respectively. Therefore the null hypothesis; that no relationship exists between the response given in each question and the factors scores can be rejected and the correlation deemed significant.

As highlighted by black circles in Figure 19 and Figure 20, the factors scores that most influence the relevant factor, i.e. those with the highest value, are colour coded by the response given to the question being tested. Therefore, the question response that most influences each factor can be observed. Figure 19

and Figure 20 show that it is a 'yes' response to questions 20a and 20e that most influences factor one and factor four respectively.

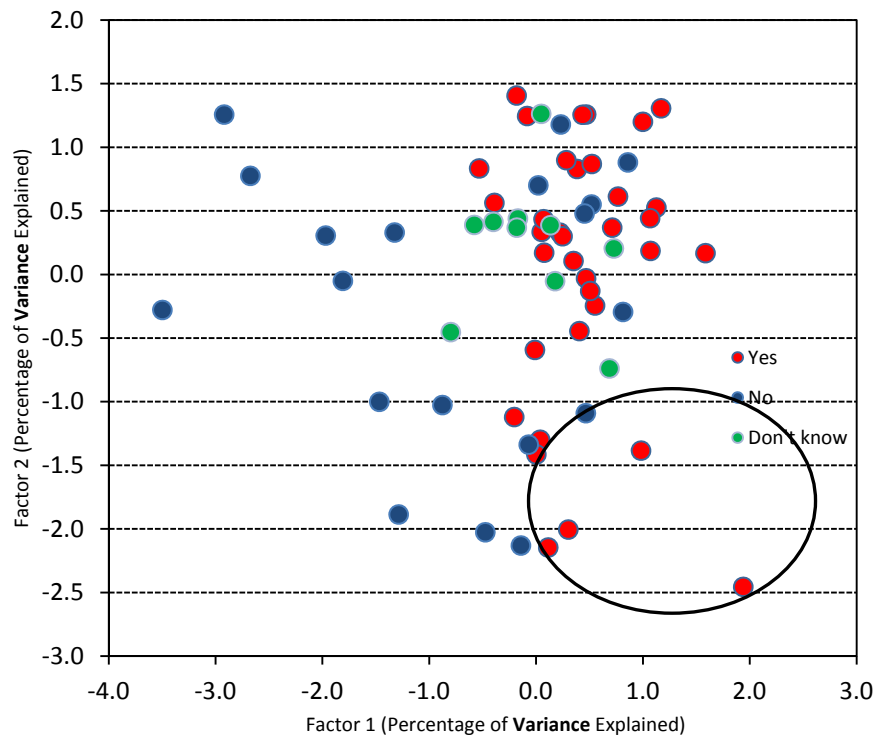


Figure 19: Scatter Plot of Factors 1 and 2 Labelled by Question 20a

Ref: Appendix C Figure C 9

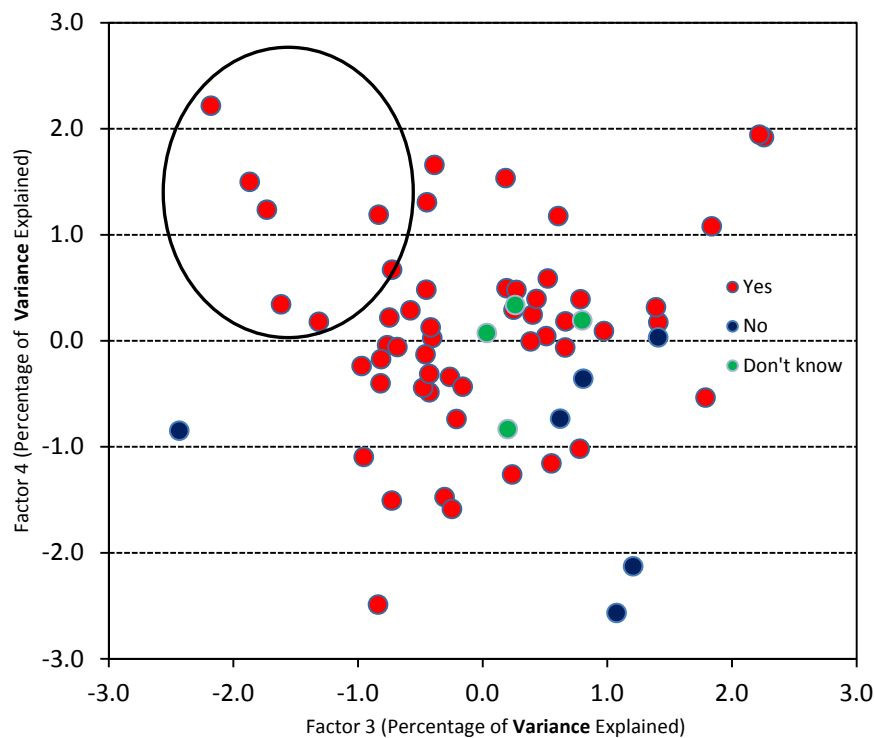


Figure 20: Scatter Plot of Factors 3 and 4 Labelled by Question 20e

Ref: Appendix C Figure C 14

This testing process was undertaken for all of the 26 questions that were not formatted using the Likert Type 5 Scale and therefore used in the construction of the initial factor scores. The results of the process are documented in Table 10 alongside the appropriate factor. However, it must be observed that this process has a degree of subjectivity and this must be taken into account when drawing conclusions from the results provided.

7.2.1 Second Stage of the Factor Analysis Results

The second stage of extracting information from the data also required factor analysis. The same four factors as previously examined were normalised through a Varimax rotation. This allowed the investigation of those questions most significant to the factor scores. Next, the distribution of the independent variable (the response recorded on the Likert Type 5 Scale) was measured as a correlation coefficient (r). Those with limited distribution, along the Likert Scale, were eliminated. The criteria for elimination of a question were that the

independent variable, r , was below 0.7, as per Juniper et al (2011). The remaining questions, those where r was greater than 0.7, were grouped by similarities in question type and in terms of their relationships with specific factors. An example of these questions is shown in Appendix C Table C1.

This process enabled previously unobservable patterns in the data to be seen. For example; factor 1, which explains 23% of the variation in the data, is predominately influenced by five questions. Three of these questions asked respondents to value; new business, retention of existing customers and improved efficiencies of internal processes in terms of the perceived increased benefit received through the implementation of ISO 14001. Factor 1 was also influenced by two questions relating to the perceived financial benefits of ISO 14001 implementation, specifically waste and processes efficiency. Therefore, factor 1 can be seen to relate to the 'external benefits' of implementing ISO 14001. The remaining three factors also exhibited relationships with specific topics; benefit of external consultancy, ensuring compliance, and performance internal benefits.

Table 9 lists the titles for the relationship evident in each of the four factors and the respective r values, with those above 0.7 highlighted. The table shows that clear relationships exist between each factor and relationship titles.

Table 9: Results of final Factor analysis

Factor Relationships	Factor 1	Factor 2	Factor 3	Factor 4
External Benefits	0.790638	0.038557	0.013292	0.012000
External Benefits	0.900919	0.057527	0.002254	0.136344
External Benefits	0.773877	0.106121	0.223459	0.105876
Ensuring Compliance	0.120811	0.137137	0.704152	0.058932
Ensuring Compliance	0.076657	0.060624	0.817581	0.178989
Ensuring Compliance	0.073149	0.112274	0.855629	0.033272
Value of External Consultancy	0.131704	0.919645	0.046258	0.013385
Value of External Consultancy	0.000791	0.961417	0.033087	0.022393
Value of External Consultancy	0.008553	0.946006	0.026686	0.022017
Internal Benefits	0.879964	0.018572	0.031066	0.009278
Internal Benefits	0.875336	0.044265	0.012010	0.081078
Internal Benefits	0.091669	0.090603	0.056034	0.841808
Internal Benefits	0.057334	0.080787	0.114545	0.837026
Internal Benefits	0.124625	0.035079	0.063977	0.753844
Ensuring Compliance	0.059891	0.288684	0.166182	0.426104
Percentage of Variation Explained	23%	18%	15%	14%

Figure 21 and Figure 22 are scatter plot graphs using factor one and three as the horizontal axes and factors two and four as the vertical axes. Those factors that produced a correlation coefficient above 0.7 have been plotted. Individual plots have then been labelled with the relevant factor title. This process highlights the clear relationship between the aspects of the questions that most significantly influence each factor.

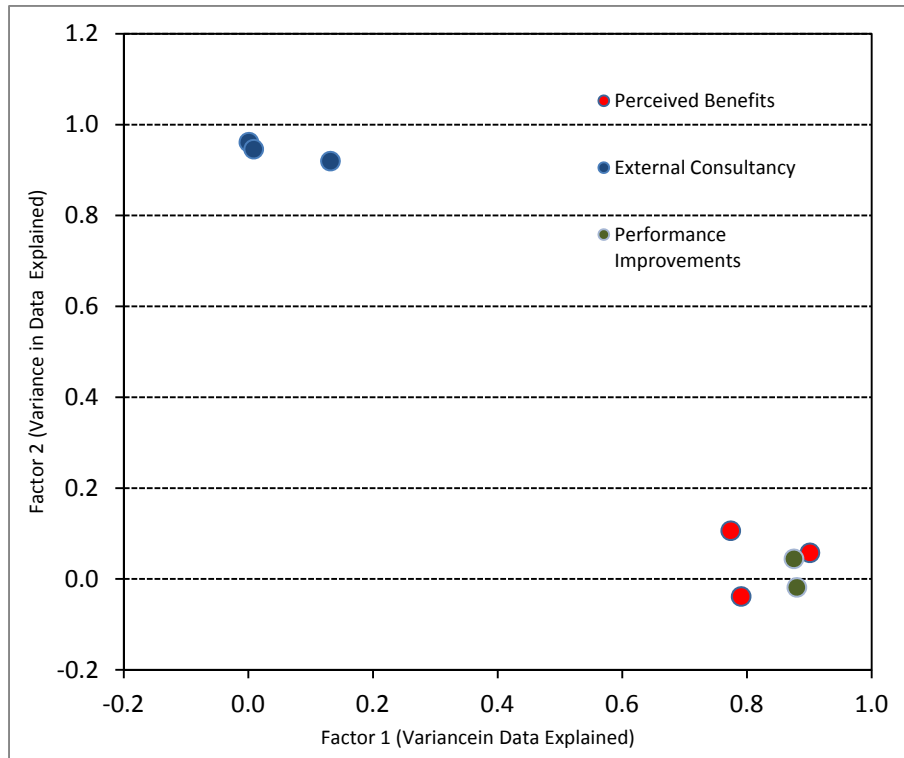


Figure 21: Factor 1 and 2 Groupings of Questions where the Principal Component was Greater than 0.7

Ref: Appendix C Figure C 1

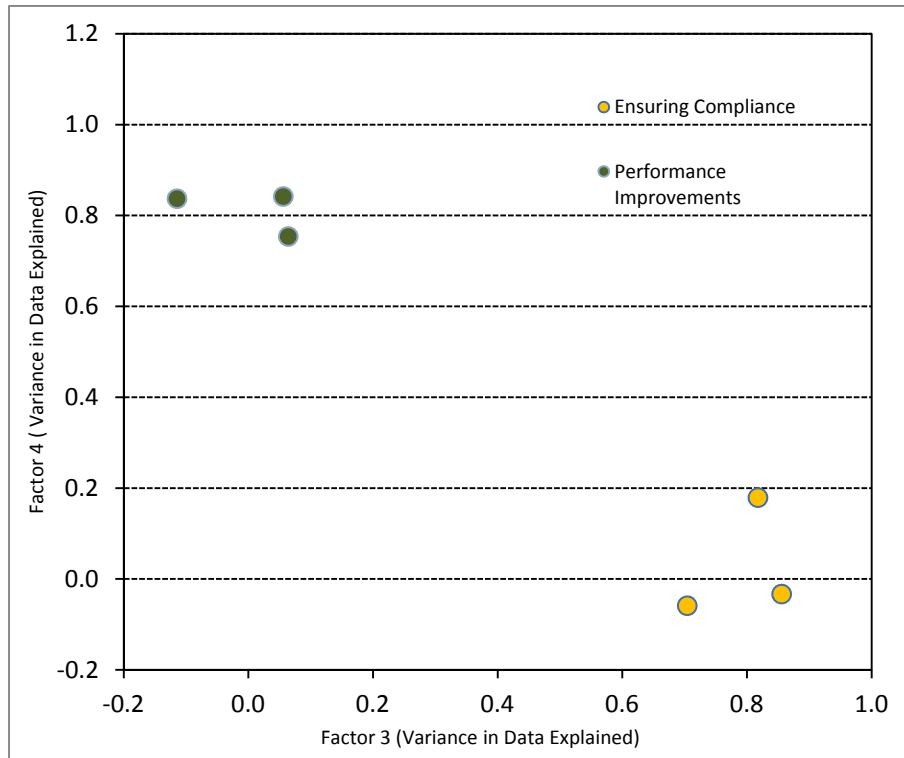


Figure 22: Factor 3 and 4 Groupings of Questions where the Principal Component was Greater than 0.7

Ref: Appendix C Figure C 2

7.2.2 Combining the Results from Stage1 and 2

The two methods of data analysis used have provided 4 factors that, between them, explain 69% of the variation in the data. Through investigation of the composition of the questions that most influence these factors it has been possible to attribute titles to each factor that relate to specific topics. It has also been possible to assess whether other questions show any significant relationship with those factors. Furthermore, it has been possible to determine the response to these questions that are most significant to each factor. The combination of these methods has, therefore, provided a classification of documented diversity in opinion related to ISO 14001. It is proposed that these categories provide a basis to classify organisations in a way that is not related to only one category as is so often the case (Zorpas, 2010; Hillary and Burr, 2011; Hillary, 2004) but instead encompasses multiple criteria that exhibit a wide diversity in opinion.

Table 10 provides a synopsis of the combined results from stage 1 and 2 of the data analysis, providing:

- A list of the most significant questions that comprise each factor.
- A list of the questions that show a statistically significant relationship with each factor.
 - Individual cells for each question have been colour coded with red, yellow and green to distinguish between negative, indifferent or positive question responses respectively.
- A synopsis of the composition of each list.

N.B. It should be noted that questions shown as having a 'statistically significant relationship with each factor' are not individually related to 'significant questions that comprise each factor' but the factor itself.

Table 10: A Table of the Combined Results from stage 1 and 2 of the Data Analysis

Most Significant Questions that Comprise Factor 1 (<i>Stage 2</i>)	Questions that Show a Statistically Significant Relationship with Factor 1 (<i>Stage 1</i>)	Most Significant Questions that Comprise Factor 2 (<i>Stage 2</i>)	Questions that Show a Statistically Significant Relationship with Factor 2 (<i>Stage 1</i>)
Factor 1 – Internal Benefits		Factor 2 – Value of External Consultancy	
Factor 1 accounts for 22.9% of the variance in the data and the questions that relate to this factor are predominately concerned with the perceived benefits of EMS implementation	Questions that show a relationship with factor 1 tend to be either positive regarding positive aspects of implementation or attributing little value to potential barriers	Factor 2 accounts for 17.6% of the variance in the data and the questions that relate to this factor are predominately concerned with the value of external consultancy	Questions that show a relationship with factor 2 are all concerned with training and auditing
<i>Has the implementation of the Environmental Management System (EMS) has been of significant value in terms of Development of new business?</i>	Do you feel the performance of your EMS has improved other aspects of performance in relation to Business development?	<i>Was external consultancy beneficial In developing the manual and operational procedures?</i>	Was relevant training and information provided to all employees in the form of formal training days run by a consultancy?
<i>Has the implementation of the Environmental Management System (EMS) has been of significant value in terms of Retention of existing customers?</i>	Do you feel the performance of your EMS has improved other aspects of performance in relation to Business retention?	<i>Was external consultancy beneficial prior to the stage 1 assessment?</i>	Rank ensuring training and awareness is sufficient in order of difficulty caused in relation to ISO 14001?
<i>Has the implementation of the Environmental Management System (EMS) has been of significant value in terms of Marketability of certification?</i>	Do you feel the performance of your EMS has improved other aspects of performance in relation to Water efficiency?	<i>Was external consultancy beneficial prior to the stage 2 assessment?</i>	Rank carrying out audits in order of difficulty caused in relation to ISO 14001?
<i>Was ISO 14001 financially beneficial in terms of Business development?</i>	To what extent did instruction from head office influence your decision to implement ISO 14001?		

<i>Was ISO 14001 financially beneficial in terms of Business retention?</i>	To what extent did availability of grants influence your decision to implement ISO 14001?		
	Rank identifying your aspects and impacts in order of difficulty caused in relation to ISO 14001:		
	Rank compiling the legal register in order of difficulty caused in relation to ISO 14001?		
	Rank Management review in order of difficulty caused in relation to ISO 14001?		
	Was the management review and auditing important in terms of compliance to the requirements of ISO 14001?		
	How important are the management review and auditing are important in terms of not receiving any nonconformities ?		

Most Significant Questions that Comprise Factor 3 (Stage 2)	Questions that Show a Statistically Significant Relationship with Factor 3 (Stage 1)	Most Significant Questions that Comprise Factor 4 (Stage 2)	Questions that Show a Statistically Significant Relationship with Factor 4 (Stage 1)
Factor 3 - Ensuring Compliance		Factor 4 – Internal Benefits	
Factor 3 accounts for 14.8% of the variance in the data and the questions that relate to this factor are predominately concerned with ensuring compliance	Questions related to factor 3 comprise aspects of the standard that are most likely to cause compliance related issues	Factor 4 accounts for 13.9% of the variance in the data and the questions that relate to this factor are predominately concerned with the potential financial benefits	Questions related to factor 4 are, all but one, related to positive responses to the question and are predominately related to performance and financial improvements
<i>Ensuring training and awareness is sufficient is the part of an EMS we believe most likely to cause nonconformities?</i>	To what extent do enhanced efficient work practices motivate you to maintain your certification to ISO 14001?	<i>Was ISO 14001 financially beneficial in terms of Energy efficiency?</i>	Was the budgeted cost of ISO 14001 implementation was sufficient to achieve certification?
<i>Carrying out audits is the part of an EMS we believe most likely to cause nonconformities?</i>	Rank Policy Design in order of difficulty caused in relation to ISO 14001?	<i>Was ISO 14001 financially beneficial in terms of Waste?</i>	Do you feel the performance of your EMS has improved other aspects of performance in relation to Energy efficiency ?
<i>Management Review is the part of an EMS we believe most likely to cause nonconformities?</i>	Rank identifying your aspects and impacts in order of difficulty caused in relation to ISO 14001?	<i>Was ISO 14001 financially beneficial in terms of Processes efficiency?</i>	Do you feel the performance of your EMS has improved other aspects of performance in relation to Water efficiency ?
	Rank communicating the requirements of the EMS in order of difficulty caused in relation to ISO 14001?		Do you feel the performance of your EMS has improved other aspects of performance in relation to waste ?
	Rank carrying out audits in order of difficulty caused in relation to ISO 14001?		Do you feel the performance of your EMS has improved other aspects of performance in relation to Processes efficiency ?

			Was relevant training and information provided to all employees in the form of formal training days run by a consultancy?
			To what extent did Availability of grants influence your decision to implement ISO 14001?
			To what extent did pressure from customers/clients influence your decision to implement ISO 14001?
			Rank ensuring compliance to the legal register in order of difficulty caused in relation to ISO 14001?

** Individual cells for each question have been colour coded with red, yellow and green to distinguish between negative, indifferent or positive question responses respectively.*

7.3 Graphical Representation of Questionnaire Results

Illustrating the responses of the questionnaire in the form of histograms has enabled further investigation of the patterns and relationships exposed by the factor analysis. It has also provided a mechanism to further understand the results of the secondary research undertaken in chapter 3 whilst supporting or disputing the existing research in this field.

All of the graphs and tables in this chapter and Appendix D represent the percentage responses to each question, or subsection of question, from all 88 respondents.

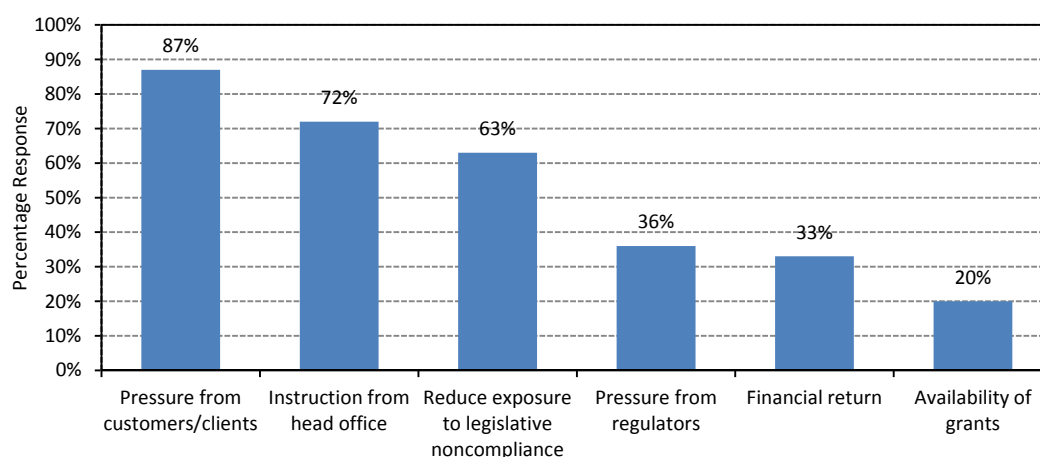


Figure 23: Question 3: The percentage of people responding “Agree or strongly agree” to the question: To what extent did each of the following drivers influence your decision to implement ISO 14001?

Ref: Appendix D Figure D 3

Question 3, Figure 23, asked: To what extent did each of the following drivers influence your decision to implement ISO 14001? Respondents were asked to score each potential response using the Likert-type 5 point scale. The results show that:

- Pressures from clients and customers provided the greatest motivation to implementation.
- Reduced exposure to legislative noncompliance ranked third.
- Financial return, at the time of implementation, was second to last as an influencing factor.

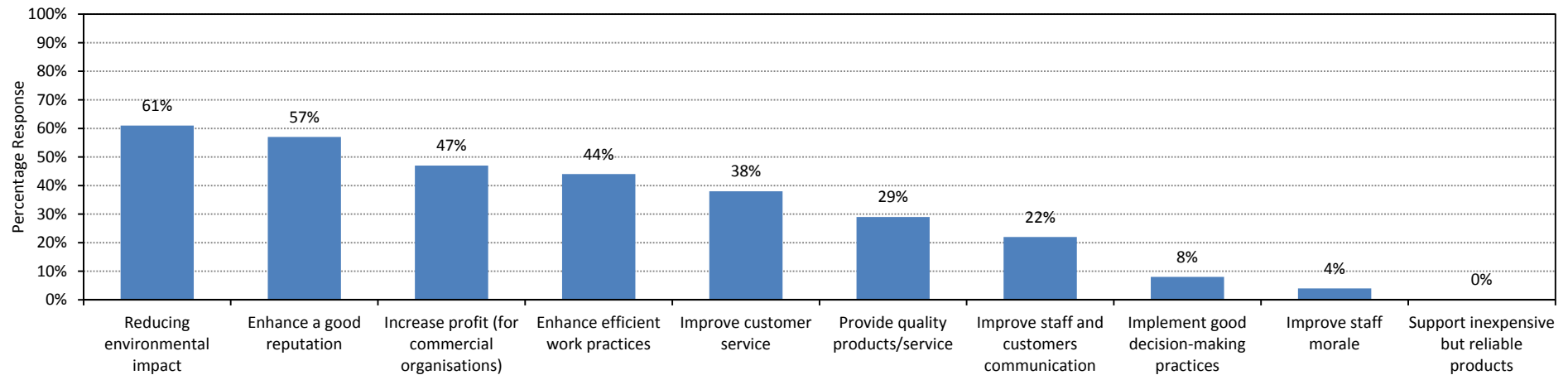


Figure 24: Question 4: The percentage of people responding "Agree or strongly agree " to the question: To what extent do the following aspects motivate you to maintain your certification to ISO 14001?

Ref: Appendix D Figure D 4

Question 4, Figure 24, asked: To what extent do the following aspects motivate you to maintain your certification? Responses show that:

- The primary motivation after certification is the reduction of environmental impacts.
- Enhance a good reputation and increased profit is the second and third most common motivations to maintain certification to ISO 14001 respectively.
- None of the respondents reported that implementation of ISO 14001 had supported inexpensive but reliable products.

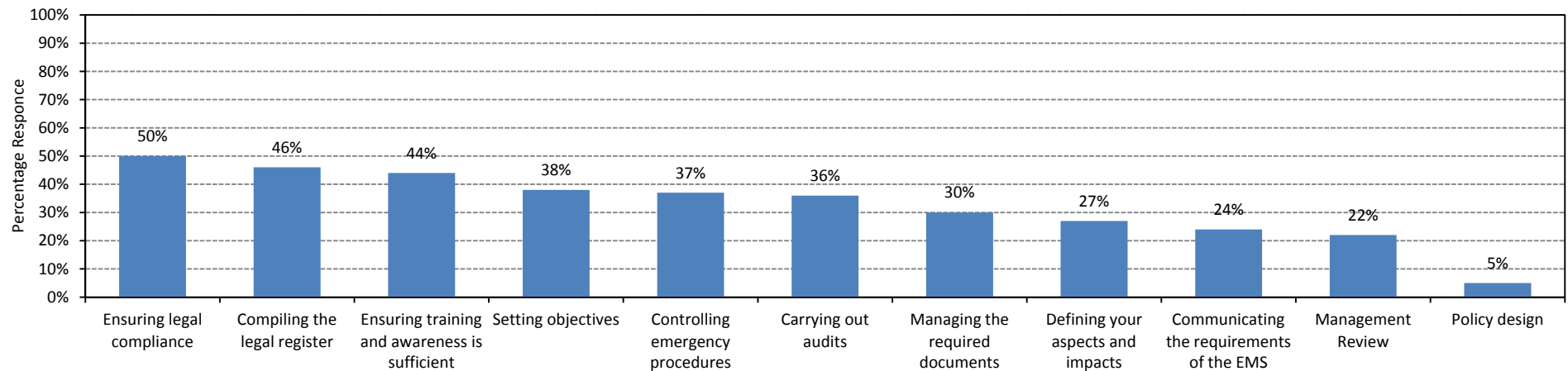


Figure 25: Question 7: The percentage of people responding “Agree or strongly agree” to: the question: Which aspects of your EMS do you believe are most likely to cause nonconformities?

Appendix D Figure D 7

Question 7, Figure 25, asked: Which aspects of your EMS do you believe are most likely to cause nonconformities?

- The two areas of the EMS most commonly believed to be the cause of nonconformities are ensuring legal compliance and compiling the legal register with 50% and 46% respectively agreeing or strongly agreeing with this.
- Ensuring training and employee awareness is sufficient in relation to the EMS was agreed or strongly agreed to be an area likely to cause nonconformities by 44% of respondents.
- Identifying the aspects and impacts was deemed by 27% of respondents as an area they agreed or strongly agreed to be the cause of nonconformities.

- Management review, at 22%, and policy design, at 7%, were perceived as the areas of the EMS least likely to cause nonconformities

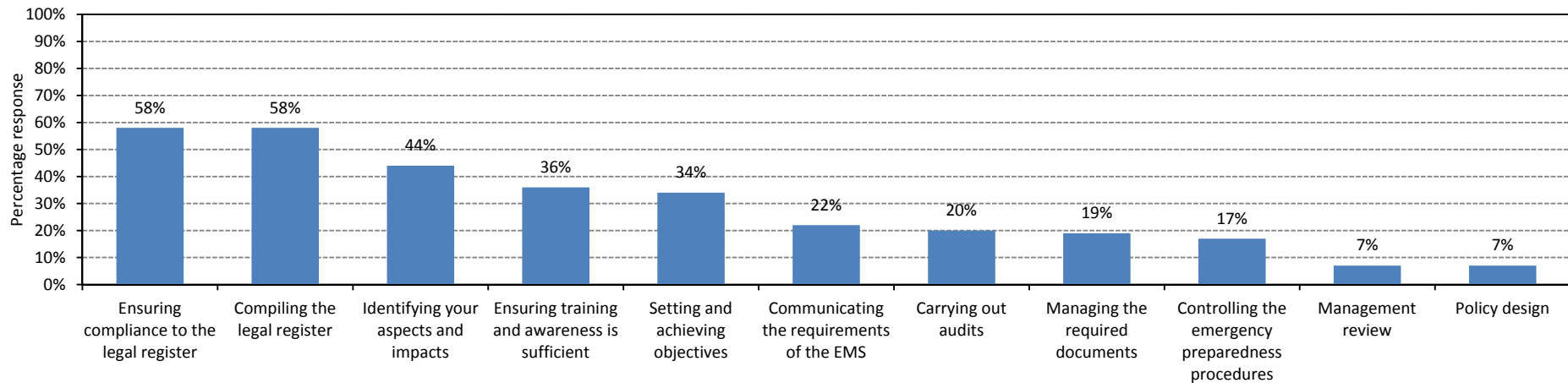


Figure 26: Question 17: The percentage of people responding “Agree or strongly agree” to the question: The aspects of your EMS you believe actually caused the most problems

Ref: Appendix D Figure D 17

Question 17, Figure 26, asked: The aspects of your EMS you believe actually caused the most problems.

- The two most common options for clauses of the standard the respondents believed actually caused the most nonconformities was ensuring compliance to the legal register and compiling the legal register.
- Identifying the aspects and impacts was deemed by 44% of respondents as an area they agreed or strongly agreed to actually cause of nonconformities
- Ensuring training and awareness is sufficient in relation to the EMS was agreed or strongly agreed to be an area actually likely to cause nonconformities by 36% of respondents.
- Management review was believed to actually cause nonconformities only 7% of the time.

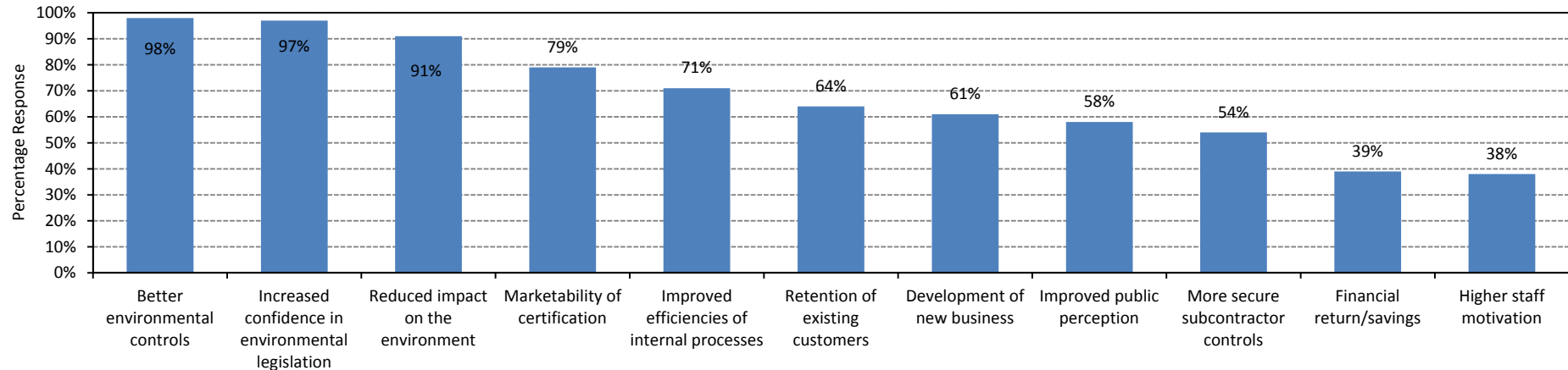


Figure 27: Question 6: The percentage of people responding “Agree or strongly agree” to the question: The implementation of the Environmental Management System (EMS) has been of significant value in terms of:

Ref: Appendix D Figure D 6

Question 6, Figure 27, asked: The implementation of the EMS has been of significant value in terms of a number of pre defined criteria? The results showed that:

- 97% of respondents believed implementation had increased confidence in environmental legislation and was deemed a greater value than the reduced impact on the environment brought about by ISO 14001 certification.
- 64% believed implementation had been beneficial in relation to retention of existing customers.
- Only 39% of respondents deemed financial return/savings as significant in value.

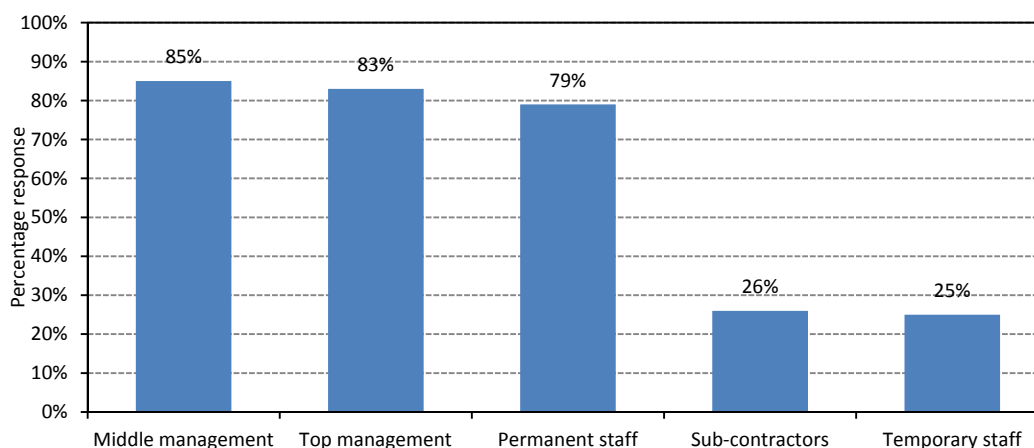


Figure 28: Question 35: The percentage of people responding “Agree” to the question: For each sector please state the level of commitment you believe was achieved in relation to your EMS

Ref: Appendix D Figure D 35

Question 35, Figure 28, asked respondents the perceived commitment to the EMS given by 5 predetermined groups.

- There is a clear disparity between perceived commitment achieved in relation to EMS by permanent staff, including management and temporary staff or external contractors.

Table 11: Question 8: Does your organisation maintain certification to other standards? If so which ones?

Additional standards	Percentage of organisations
Organisations that have ISO 14001 and at least one other Standard	84.%
Organisations that have ISO 14001 and at least two other Standards	42.%
Organisations that have ISO 14001 and ISO 9001	72%
Organisations that have ISO 14001 and BS EN 18001	16%
Organisations that have ISO 14001 and other ISO standard (Not ISO 9001 or BS OHSAS 18001)	18%
Organisations that have ISO 14001 and another non ISO standard	23%

Ref: Appendix F.D Table 1

Question 8, Table 11, asked: Does your organisation maintain certification to other standards? If so which ones?

- 84% of those certified to ISO14001 also hold certification to at least one other standard and 42% to at least two other standards.
- The most common pairing with ISO 14001 is ISO 90001 (British Standards Institution, 2008) the quality management system
- 22.7% of respondents held certification to another standard that is not another standard controlled by the International ISO. These included investors in people, FSC certification and carbon management and reduction systems.

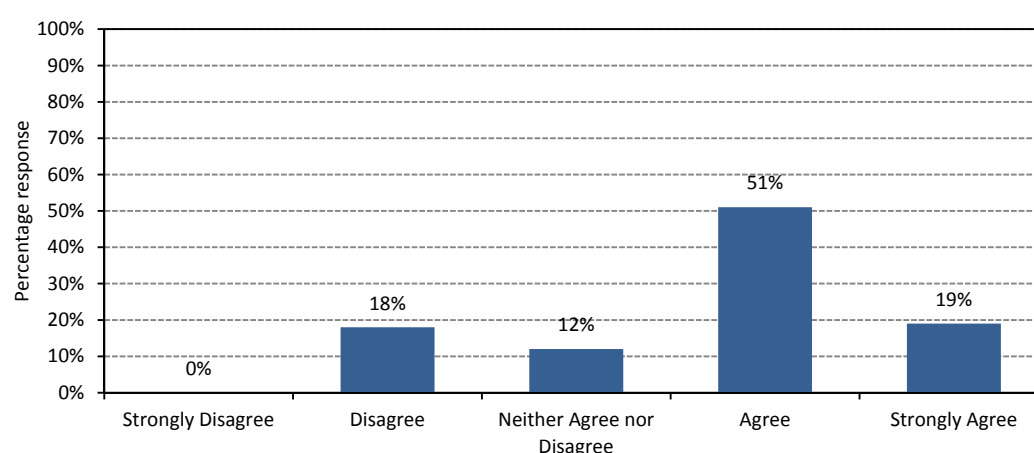


Figure 29: Question 9: Our organisation integrates its policy and procedures for multiple standards

Ref: Appendix D: Figure D 9

Question 9, Figure 29, asked if the organisation integrates its policy and procedures for multiple standards. The results show that 70% of the organisations stated they were certified to more than one standard and agreed or strongly agreed with the question 9 and 18% disagreed. However, some of the qualitative responses from the questionnaire suggest a difference in the interpretation of the concept of integration:

- *The policy is not integrated but the procedures are.*
- *Have just completed a single system audit for 14001, 9001, 18001 and 27001 and passed. Is saving business £1000's in terms of auditor costs and time spent on managing systems. This was driven by a forward thinking Compliance Director, not by Senior Management.*

- *We used to and have a joint audit. We haven't changed the procedures since giving back the certificate.*
- *The scope for each standard is not the same which makes integration impossible at present.*
- *We only integrate the 18001 & 14001 (the 9001 is stand alone).*
- *Currently operate integrated system to 9001, 14001 and 18001.*

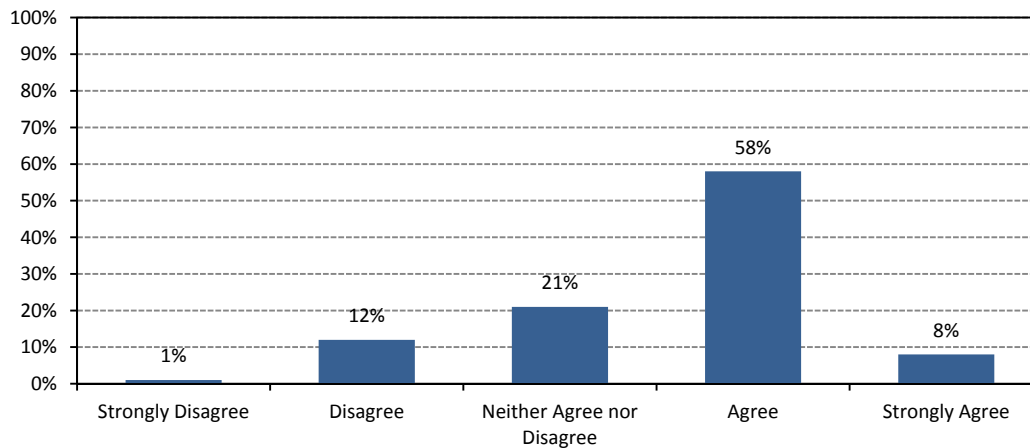


Figure 30: Question 14: Responses to the statement: Our EMS is integrated with existing processes and procedures e.g. setting of objective and/or purchasing

Ref: Appendix D: Figure D 14

Question 14, Figure 30, asked if the organisation's EMS was integrated with existing processes and procedures e.g. setting of objective and/or purchasing:

- 66% of respondents agreed or strongly agreed that their EMS was integrated with existing processes and procedures with only 12% disagreeing.

However, there was again, a certain level of disparity in the concept of integration shown by the qualitative data collected.

- *The only aspect of our EMS that is integrated into our processes and procedures is that which is required to ensure legal compliance.*
- *Agree to some degree. Integrated with internal processes but business structure and lack of ambition from Senior Management are restricting improvements to supplier environmental management.*
- *Integration is a weakness, but we are improving in this area.*
- *We would not be able to retain our accreditation if we did not integrate with purchasing, but Objective Setting is kept separate*

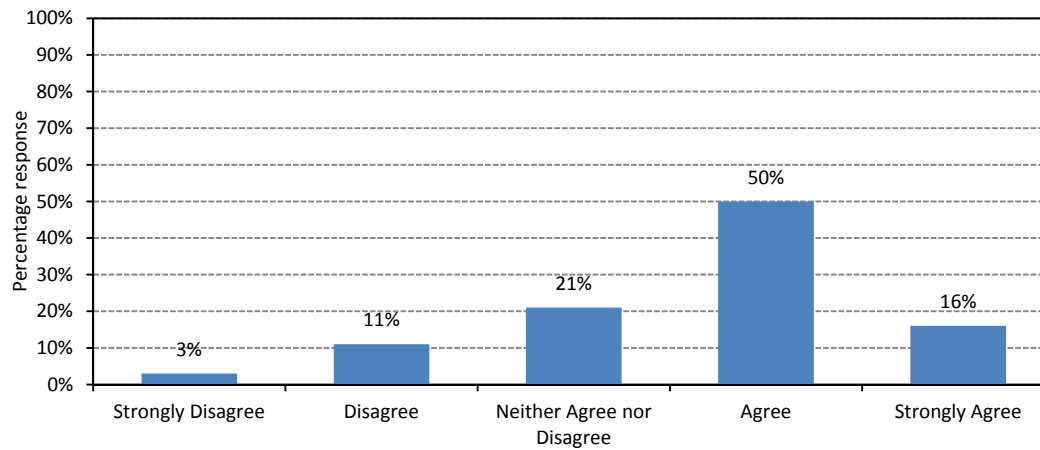


Figure 31: Question 5: Since the initial decision to implement ISO 14001 was made it has become more fundamental to the organisations business development?

Ref: Appendix D Figure D 5

Question 5, Figure 31, asked: To what level has the implementation of ISO 14001 become more fundamental to business development?

- 66% of respondents agreed or strongly agreed to this statement and only 3% strongly disagreed.

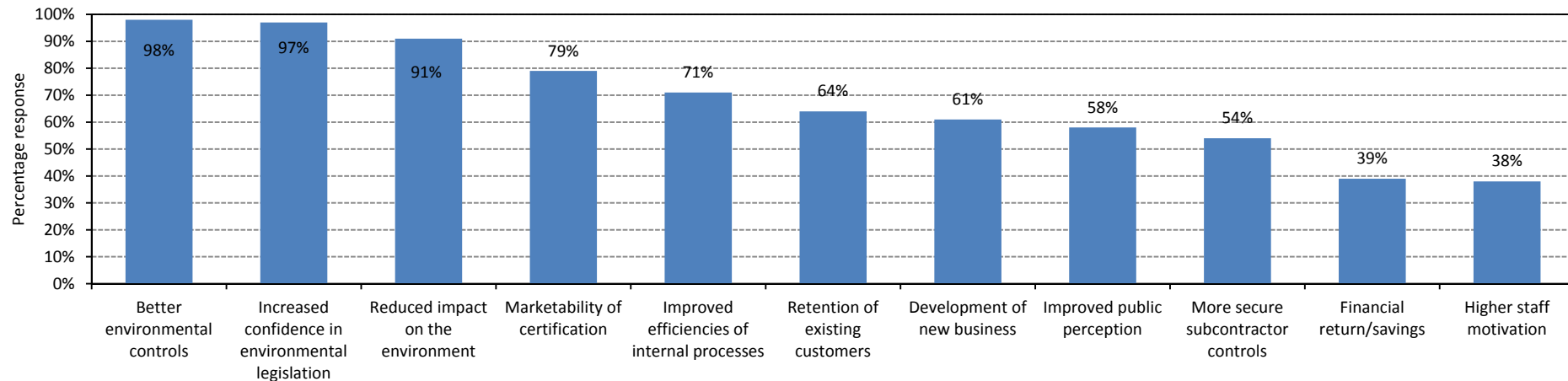


Figure 32: Question 6: The percentage of people responding “Agree and strongly” to the question: The implementation of the EMS has been of significant value in terms of:

Ref: Appendix D Figure D 6

Question 6, Figure 32, asked: In what areas had implementation of ISO 14001 provided significant value in relation to 12 predefined criteria. The results showed that:

- Improved environmental controls, a reduction of environmental impacts and increased confidence in relevant legislation were deemed the areas where most value was gained. 82%, 67% and 65% of respondents selected these as the primary or secondary greatest significant financial benefit respectively. This supports the results seen in questions 3 and 4 (Figure 23 and Figure 24) which show these topics to be key motivations for the implementation and ongoing management of the standard.
- After legislation and improved environmental impacts, the eight remaining categories are business focused, both in financial terms, employee controls and motivation, these group record percentages of between 79% and 38%.

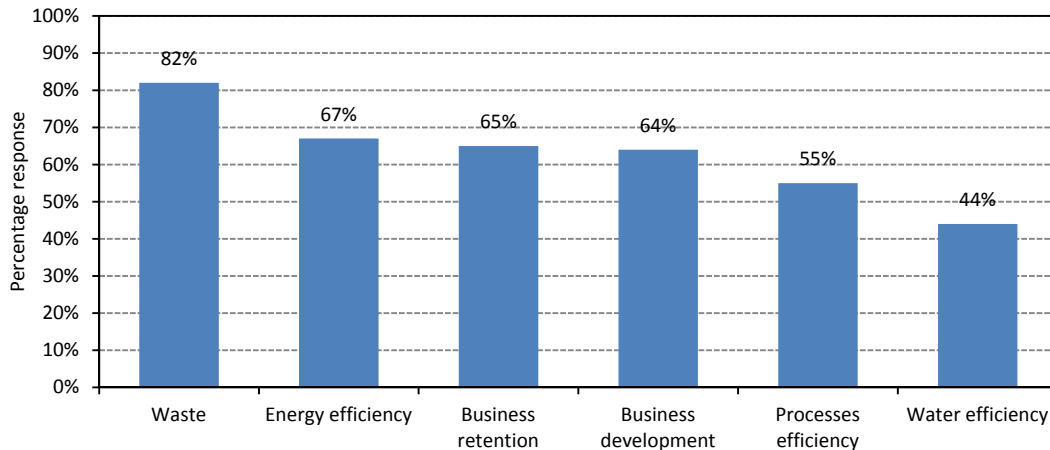


Figure 33: Question 19: The percentage of people responding “Agree or strongly agree” to the question: ISO 14001 was financially beneficial in terms of

Ref: Appendix D Figure D 19

Question 19, Figure 33, asked: Was ISO 14001 was financially beneficial in terms of six predetermined options:

- 82% of respondents saw financial benefit in waste.
- 67% of respondents saw financial benefit through energy efficiency
- Business retention and development were deemed areas where financial benefits were achieved by 65% and 64% respectively.
- Water was seen, by only 44%, as an area of financial benefit.

Question 28 asked for a qualitative response to the question: What key lessons/skills have you learnt through ISO 14001 implementation? The responses to this question were:

- *The further you go the more the improvement goals become difficult as the system only requires managing as opposed to improving. Improvement objectives have to be thought of "outside of the box" - no more quick wins.*
- *Dont rush these changes and allow take up time for organisation*
- *The importance of communication*
- *Better ways of controlling/reducing environmental impacts. Better awareness of legal and other requirements.*

- *improvement targets can benefit both environmental reductions & cost savings*
- *Best when integrated with other work practices. The danger of it being a stand-alone system is that it doesn't get the priority it deserves. Safety and Financial aspects will be prioritised*
- *That it is not as expensive an exercise as previously thought, there is actually money to be saved. Organisation-wide acceptance and improvements. Staff morale and motivation through training*
- *No key lessons*
- *HARD WORK, DETERMINATION, ENVIRONMENTAL AWARENESS*

7.4 Conclusion

The treatment of the data as depicted in this chapter has provided information that increases the understanding of what motivates organisations to implement and maintain ISO 14001. Furthermore, it has advanced knowledge of the perceived barriers to ISO 14001 implementation, showing which aspects of the standard most concern participants.

The development of the four factors provides an opportunity to understand much of the behaviour and opinion expressed by those participating in the questionnaire within manageable groups. It is proposed that these groups, subsequently, provide a opportunity to classify organisations through multiple criteria that exhibit a wide diversity in opinion.

References

- BRITISH STANDARDS INSTITUTION (2008) BS EN ISO 9001:2008 Quality Management Systems Requirements. BSI.
- GREENWOOD, P. E. and NIKULIN, M. S. (1996) *A guide to chi-squared testing (Wiley Series in Probability and Statistics)* New York Wiley and sons
- HILLARY, R. (2004) Environmental management systems and the smaller enterprise. *SME and Experiences with Environmental Management Systems*, 12, 561-569.
- HILLARY, R. and BURR, P. (2011) Evidence-based Study into the Benefits of EMSs for SME. DEFRA.
- ZORPAS, A. (2010) Environmental management systems as sustainable tools in the way of life for the SME and VSME. *Bioresource technology*, 101, 1544-1557.

8 Conclusion

This chapter will outline development of this research project. The function of each of chapter will be outlined in terms of the conclusions drawn from it and the subsequent influence on the progress of the research as described in the following chapters.

8.1 Chapter 2 Literature review

The purpose of chapter 2 was to undertake a review of the prior art. Through this process the limitations of existing research and gaps in the existing knowledge became clear. This in turn led to the development of three objectives that would direct this research project, as follows

- Investigate the similarities and differences between the different instruments available to support organisations that wish to adopt or improve in the implementation of environmental management, thereby creating a knowledge base capable of demonstrating opportunities for integration and resource saving.
- Develop a clear understanding of the certification and implementation processes for ISO 14001 and the issues experienced by organisations of all sizes, with the aim to develop proposals for improvement.
- Develop a method for categorisation beyond that of SME and non SME that enables a classification process to best highlight the barriers and motivations for EMS implementation within SME.

8.2 Chapter 3 Investigation into voluntary instruments

The research undertaken in Chapter two showed that existing literature focused on a small number of voluntary instruments that could support organisations to improve their environmental management (Heras and Arana, 2010; Castka and Balzarova, 2008; Beltrán et al., 2010). Furthermore, existing literature had neglected consideration of the composition of the various instruments' specific requirements and the consequent potential for opportunities for integration. (Hillary, 2004; Zorpas, 2010; Perez-Sanchez et al., 2003)

Chapter 2 undertook a detailed review of 13 voluntary instruments that offered opportunity to improve an organisation's environmental management. Each

instrument was reviewed in terms of its specific requirements and as to whether these correlated with any of the other instruments under review

The research showed:

- Significant commonality exists between the specific requirements of the 13 standards reviewed.
- Standards written by ISO or EMAS have greater similarities than those that are not and standards dealing with CO₂ specifically have greater similarities than those that focus on the wider environment.
- A considerable proportion of organisations that maintain certification to one standard maintain certification to at least one other standard and therefore there is potential for integration of their implementation.

This chapter highlighted the complexity of the requirements dictated by the 13 voluntary instruments. The next objective of the research was to develop a better understanding of the implementation process for one of these instruments. Chapter 2 showed that for this to be achieved it would not be sufficient to review the instrument as a whole as had previously been done (Hillary, 2004; Zorpas, 2010; Perez-Sanchez et al., 2003). Instead a review of the barriers raised by individual requirements of the instrument was necessary.

8.3 Chapter 4 Analysis of ISO 14001 Non conformities

Chapter 4 reports on an opportunity to investigate a database of the occurrence of non-conformities raised during the external audit process of ISO 14001 for over 850 organisations of various sizes and activities.

The conclusions drawn by previous research has suggested that different organisations face different barriers to the implementation of an EMS. However, these conclusions are often anecdotal in nature and based on small scale research projects. The analysis of the data provided by SGS allows a comprehensive understanding of the specific barriers related to the individual clauses of ISO 14001 for a wide spectrum of organisations.

An in depth investigation of the database led to the observation of previously unseen response patterns related to ISO 14001 implementation and on-going certification.

- Specific clauses of ISO 14001 caused nonconformities more regularly during the certification process and therefore may be considered to present greater barriers.
- A smaller organisational size was shown not to be a limiting factor for success and the outcomes for different activity sectors did not show meaningful variation in their response to the certification process.
- The evidence suggested that smaller organisations seem to adapt more quickly and with less difficulty to resolve nonconformities raised in the audit process.
- Categorisation by organisational type, in this instance manufacturing and service based industries, showed no discernible differences in the patterns in the occurrences of nonconformities.

Chapter 3 showed that organisational size and type, whilst offering a seemingly logical approach to categorisation, were unable to fully expose the true underlying factors that affect ISO 14001 implementation. As such a need was shown to exist to develop a more comprehensive method of organisational categorisation that would allow meaningful patterns in the barriers to implementation of EMS to be more fully understood.

8.4 Chapter 5 Classification of organisations

In response to the conclusions of the research outlined in Chapter 4, Chapter 5 investigated the existing prior art regarding the categorisation of organisations in relation to environmental management beyond those of organisational size and type. The prior research has shown that organisational size and type were, by far, the two most common methods of organisational categorisation in relation to the understanding of ISO 14001 implementation.

It was shown that much of the discussion surrounding classification methods, although developed from sound academic bases, had little proven value in terms of practical application in relation to EMS.

The research showed:

- An inherent lack of understanding exists regarding the true barriers to the practises involved in the certification and implementation of an EMS
- A single criterion approach to categorisation neglected much of the inherent heterogeneity prevalent within organisations.
- The process of classification is often confused through the use of multiple methodologies and a limited understanding of the notion of taxonomy.
- No clear basis exists currently for the development of relevant classification processes.

Chapter 4 showed that a wider understanding of the factors that might influence EMS implementation was required. Furthermore, appropriate categorisation should encapsulate these factors in terms of the specific motivations and barriers they produced when associated with EMS.

8.5 Chapter 7 Questionnaire Results

Chapter Seven provided an opportunity to collate and investigate the collected questionnaire data related to organisations' behaviours for implementing ISO 14001 and the perceived barriers faced.

Through a review of the previous research it has been shown that organisations face issues both in terms of motivations and barriers when considering the reduction of their environmental impacts

The collection of this data supported the objectives of this research through furthering the understanding of the perceived barriers and motivations for ISO 14001 certification and implementation. Furthermore, through statistical analysis of the questionnaire responses, a method for organisational classification that encompassed those factors that generated the greatest variation between organisations related to the barriers and motivations for EMS implementation was developed.

The results of the analysis of the questionnaire data are collated in Chapter 6 and showed:

- Pressures from clients and customers provided the greatest motivation to implement of ISO 14001. Instruction from head office and reduced exposure to legislative noncompliance ranked second and third respectively.
- The primary motivation to continued certification to ISO 14001 was the reduction of environmental impacts. Enhanced reputation and increased profit ranked second and third respectively.
- The two clauses of the standard respondents believed actually caused the most nonconformities were; ensuring compliance to the legal register and compiling the legal register.
- 84% of those questioned hold certification to at least one other standard beyond ISO 14001
- The most common pairing with ISO 14001 is BS EN ISO 9001:2008.
- 82% of respondents saw financial benefit in waste reduction.

The in depth factor analysis of the questionnaire data provided:

- A set of four factors that exhibit relationships displaying the widest disparity in opinion in relation to ISO 14001 implementation. These 4 factors described a total of 69% of the variability in responses to the questionnaire questions. Individually, responsibility for variability in responses for the factors was:
 - Factor 1 – 22.9%
 - Factor 2 – 17.6%
 - Factor 3 – 14.8%
 - Factor 4 - 13.9%
- An ability to represent statistically meaningful connections between the principle components of each of the four factors and opinions from the questionnaire that relate to other aspects of ISO 14001 implementation displaying the fundamental nature of each factor:
 - Factor 1 - 5 principal components are included in this factor and are derived from question 6 and 19. Parts of questions 3, 7 and 20 show significant correlation.

- Factor 2 - 3 principal components are included in this factor and are derived from question 11. Parts of questions 17 and 29 show significant correlation
- Factor 3 - 3 principal components are included in this factor and are derived from question 7. Parts of questions 4 and 17 show significant correlation
- Factor 4 - 3 principal components are included in this factor and are derived from question 19. Parts of questions 18 and 20 show significant correlation

Table 12 provides a synopsis of the factor and question compositions. A complete table of these results is available in the results chapter of this research.

Table 12: A Synopsis of the Factor and Question Compositions

Factor 1 – External Benefits		Factor 2 – Value of External Consultancy	
Factor Principal Components	Significant Questions	Factor Principal Components	Significant Questions
Question 6	Question 3	Question 11	Question 17
Benefits of implementation related to business development, retention and marketability of certification	As drivers for implementation responses were grants are negative and instruction from head office positive	The benefits of external consultancy relating to the development of the manual and stage 1 & 2 of assessment.	Those perceiving training and awareness & audits as actually causing nonconformities
Question 19	Question 7		Question 29
Financial benefits of implementation related to business development and retention	Responses showing the identification of aspects and impacts as less significant reason for nonconformities		Those providing training through formal training days
	Question 20		
	Responses showing the EMS had enhanced business development and retention but a negative in relation to water efficiency		
Factor 3 – Ensuring Compliance		Factor 4 – Internal Benefits	
Factor Principal Components	Significant Questions	Factor Principal Components	Significant Questions
Question 7	Question 4	Question 19	Question 18
The potential for training, audits & management review to cause nonconformities	Those not motivated to maintain certification through enhanced efficient work practices	Financial benefits achieved through; energy & process efficiency and waste.	A positive belief that the budgeted cost of implementation was sufficient
	Question 17		Question 20
	Those who have strong opinions on; policy design, aspects & impacts, communication & audits as potential for nonconformities		Positive achievements made in relation to waste, water, energy & process efficiencies

- The Final titles given to the four factors derived from the principle components and significant questions related to each factor are:
 - Factor 1 – External Benefits
 - Factor 2 – Value of External Consultancy
 - Factor 3 - Ensuring Compliance
 - Factor 4 – Internal Benefits

Chapter 7 has provided objective evidence related to the motivations and barriers to EMS implementation. Furthermore, it has provided a foundation for categorising organisations that encapsulates the most significant opinions related to the barriers and motivations for EMS implementation.

8.6 Conclusion

This chapter has provided a narrative of the research approach taken in the pursuit of the research objectives defined through a review of previous research and the conclusions drawn. This showed that not only was there a need to better understand the motivations and barriers to ISO 14001 implementation, but also to supersede conclusions and opinion based on largely anecdotal evidence with a comprehensive and deductive approach to the research.

With the development of each chapter and the specific conclusions reached the limitations of the prior research have been addressed. This research has provided a comprehensive investigation in to the potential benefits that voluntary standards offer organisations adopting a policy of improved environmental management. Furthermore, it has outlined related criterion better able to distinguish organisations into meaningful groups.

It has been shown that each chapter has reached specific conclusions which have further influenced the direction of the research process. The following discussion chapter considers the implications of the results of the research and provides a review of the degree to which the original research objectives have been achieved and how this directs the needs for further research.

9 Discussion

9.1 Introduction

This chapter will consider the implications of the conclusions reached through this research project. A discussion will be provided to show how each of the three objectives, developed through a review of the prior art, directed the research. The discussion will include a review of the inadequacies exposed in the existing literature and how this thesis addressed them. Furthermore, the research processes and outcomes will be assessed in terms of research achievements against the objectives and subsequent opportunities for further research outlined.

9.2 Objective 1

The first objective of this research was:

To investigate the similarities and differences between the different instruments available to support organisations that wish to adopt or improve in the implementation of environmental management, thereby creating a knowledge base capable of demonstrating opportunities for integration and resource saving.

The existing literature shows that organisations are becoming more motivated to act beyond legislative compliance regarding their environmental responsibility (Delmas and Toffel, 2008) and are utilising a number of voluntary instruments to achieve this (Alberini and Segerson, 2002; Arimura et al., 2008). However, it was evident that comparative analysis of these instruments is in its infancy. Only limited research existed in this field and was found to focus on only a small percentage of the available instruments (Heras and Arana, 2010; Castka and Balzarova, 2008; Beltrán et al., 2010). Furthermore, the majority of the literature available neglects the composition of the instrument under review and the subsequent challenges faced (Hillary, 2004; Zorpas, 2010; Perez-Sanchez et al., 2003). From this literature review it was evident that further research was required that incorporated a greater number and more diverse selection of these instruments. Furthermore, it must also provide consideration of the

composition of the various standards' specific requirements in conjunction with potential opportunities for integration.

Through an investigation of 13 voluntary instruments it has been shown that overlaps exist in the requirements of multiple standards that support improvements in environmental management. Furthermore, some organisations develop a culture of being certificated to multiple 'standards'. This culture creates opportunity for resource efficiency through the integration of clauses and requirements of standards, e.g. the ISO series 9001, 14001, 16001.

A considerable proportion of the organisations who responded to the questionnaire maintain certification to multiple standards and believe that a degree of integration has been achieved in their implementation. The qualitative data collected as part of this research shows that there is a disparity in the level of integration achieved by organisations that implement multiple standards. Additionally, a clear discrepancy exists in the understanding and interpretation of the term integration. As such, the organisations promoting integrated aspects of multiple management systems are likely to have achieved considerably different levels of successes.

In terms of the 1st objective, this research has furthered knowledge to show that, through the review of a diverse selection of instruments, there are considerable opportunities to integrate multiple voluntary instruments. This integration is achievable due to significant similarities in and overlaps of their specific requirements. In addition there is a potential for this resource efficiency to benefit multiple organisations. However, the research has also shown that the term integration may lead to confusion due to its ambiguity in this context. Therefore, a definitive clarification of what constitutes the integration of these instruments is required if it is to be meaningfully measured.

9.3 Objective 2

The second objective of this research was:

Develop a clear understanding of the certification and implementation processes for ISO 14001 and the issues experienced by organisations of all

sizes. This will allow the development of proposals for improvement in these areas.

It is clear from the existing literature that not only are the barriers to ISO 14001 not fully understood (Hillary, 2004; Zorpas, 2010) but that they are unlikely to be consistent across the categories of size (SME or Non SME) and organisation type (manufacturing or service sector) most often used in their classification (Campos, 2012; Yin and Schmeidler, 2009; Hillary, 2004). Additionally, previous investigations into ISO 14001 have not distinguished the individual clauses of ISO 14001 when discussing the potential barriers to implementation. Furthermore, conclusions mostly are seen to be anecdotal, being drawn from small scale investigations and applied to organisations categorised only through size (Hillary, 2004; Williams et al., 2000). It is suggested that the term SME is not necessarily just too vague and encompassing but potentially irrelevant in relation to better understanding of ISO 14001 implementation.

The first stage of research related to this objective involved the review of a database comprising circa 8,500 nonconformities raised by an accreditation organisation over a six year period by circa 850 organisations during the certification process for ISO 14001. This project provided statistically significant and objective evidence that specific clauses of ISO 14001 cause nonconformities during the certification process more regularly than others and therefore may be deemed to present greater barriers. The research also provided evidence that smaller organisations receive fewer nonconformities, suggesting that size is not a limiting factor for successful implementation and management of an EMS. Indeed, contrary to the existing literature, the data suggested that smaller organisations seem to adapt more quickly and with less difficulty to the resolution of nonconformities raised in the audit process, and so to EMS implementation. Neither did outcomes for different organisational types show any statistically significant variation in the occurrence of nonconformities.

The next stage of the research that influenced the outcome of the 2nd objective involved developing a better understanding of the issues experienced in EMS implementation. This was achieved through a questionnaire sent to the circa

850 organisations whose historic data had supported the 1st stage of the research, 88 responses were received. From this process it was possible to ascertain individual motivations to implementation and management of ISO 14001 as well as the perceived barriers.

It became clear that the motivations and barriers involved in the implementation of ISO 14001 and the benefits to be derived are multifaceted and interdependent and complex. It has also been shown that motivations may evolve from those extant during initial implementation through to on-going management. Key motivations are initially related to peripheral pressures from stakeholders, but environmental improvements and financial returns become more important motivators over time. Internal motivations such as staff morale and product development are shown to be less important throughout the process of certification and implementation.

It is clear that there is also a variety in interpretation of the meaning of each clause, the concept of integration, the potential benefits and the value attributed to specific achievements. This difference in interpretation suggests considerable heterogeneity in integration styles across organisations as well as an inability to develop standardised measures of success, financial or other. However, this heterogeneity in opinion and behaviour does suggest opportunities to introduce taxonomies with which to categorise organisations beyond size and industry type.

This research has shown that clauses of ISO 14001 discussing legislative compliance are believed to raise the biggest barriers to successes. However, the evidence in fact shows that clause 4.4.6 'operational control' has the greatest potential to cause nonconformities during the audit process. Therefore, there is potential to make prospective organisations aware of this evidence and offer training with specific focus on these subjects.

The analysis of the data provided by SGS has shown that the notion of SME or its sub categories SE and VSE do not offer the best mechanism for categorisation when investigating the barriers to EMS implementation. However, the results do suggest that, contrary to much of the literature, larger

organisations appear to generate more nonconformities than smaller organisations. Size did not provide a mechanism able to extract meaningful patterns in the data that other aspects of organisational behaviour and opinion did.

Therefore, in relation to the demonstrated gaps in knowledge, this research has been able to provide an objective study of the certification and implementation processes for ISO 14001. This has been achieved by establishing a knowledge base of the clauses of ISO 14001 that caused the greatest barrier to successful certification in the UK. In conjunction, a greater understanding of the motivations and perceived barriers to EMS implementation can help tailor training and allow organisations to better focus resources.

The analysis of the data provided by SGS only showed the barriers to ISO 14001 implementation that arise from the specific requirements of each clauses of the standard. However, it must be assumed that organisations will also experience hurdles to implementation that do not directly relate to the standard, for example from limited resources. A greater understanding of these hurdles would further the understanding of EMS implementation whilst offering further proposals for improvement.

9.4 Objective 3

The primary objective of this research was:

Develop a method for categorisation beyond that of SME and non SME that enables a classification process to best highlight the barriers and motivations for EMS implementation.

Considerable literature exists that attempts to explain the barriers and motivations related to EMS and specifically ISO 14001 and much of the differentiation reported is purely on the basis of organisational size (Hillary and Burr, 2011; Heras and Arana, 2010; Jabbour and Santos, 2006). However, there is little evidence that supports this choice of criterion and objective evidence from this research challenges this notion. Consequently, research was undertaken into other potential opportunities to categorise organisations in

relation to EMS. This culminated in a publication in the Journal of Environmental Management entitled, A critical review of classification of organisations in relation to the voluntary implementation of environmental management systems (Stevens et al., 2012). This article outlined the gaps in knowledge relating to existing methods of categorisation. It showed, the process of classification is often confused through the use of multiple methodologies and that there is no clear basis for the development of relevant classification processes. Furthermore, placing of organisations in to groups based upon very broad criteria does not necessarily provide clear discrimination between participants and as such existing methods of classification neglect to encompass the different requirements of organisations and their wish to achieve different outcomes beyond simple compliance to an EMS.

Utilising the findings from the article in conjunction with the other aspects of this research has provided an opportunity to collate significant data. This data is from primary and secondary sources and both qualitative and quantitative in composition. It relates to; motivations to ISO 14001 implementation, actual and perceived barriers to its implementation and the potential benefits derived. From this data it has been possible to develop a set of factors that exhibit relationships displaying the widest disparity in opinion in relation to ISO 14001. These are, in order of significance:

- External Benefits
- Value of External Consultancy
- Ensuring Compliance
- Internal Benefits

These factors provide a basis to categorise organisations motivations and barriers to ISO 14001 not through size alone but rather through the significant motivations and barriers to EMS implementation.

9.5 Limitations of the research and Proposals for Improvement

This section will identify the limitations of this research project as well as the potential opportunities for its improvement and key proposals for the furtherance of the field.

- **Data** – The data utilised in the initial stages of this research project was provided by SGS, an accredited certification body. However beneficial, this does pose potential for bias in that data from other accredited certification bodies may have presented different patterns in the results. Therefore it would be beneficial to extend this research utilising data from other accredited certification bodies both within the UK and internationally to provide a more complete understanding of the behaviours and barriers to ISO 14001.
- **Standards Addressed** – For the purpose of this research project, data relating to the standard ISO 14001 was reviewed. However, it was shown that there are many other standards capable of supporting organisations in improving their impact on the wider and local environment. Consequently, It is suggested that further research is not only undertaken on data related to ISO 14001 but, due to the considerable overlap in requirements of these standards, also on other instruments for the implementation of management systems discussed in this research, e.g. ISO 9001. This would provide not only comparative analysis of barriers to implementation and the potential for categorisation but also provide for better understanding of the individual clauses most suited to integration.
- **Questionnaire Distribution** – the questionnaire utilised for this research project was designed to remove as much potential for bias as was possible. However, due to confidentiality requirements of the organisations to be approached, the respondents were self selecting. Although this approach offered an opportunity to reach a wide variety of participants it does, however, mean the type of participants who volunteered may not have been fully representative of the target population.
- **Testing of Factors** - The source of data for this research is limited to those organisations certified to ISO 14001 by SGS. Therefore, to test the classification criteria on the same data set would provide a false

response. Future research is required to test the categorisation criteria developed as part of this research on a new set of organisations.

9.6 The Value and Benefits of this Research Project

This research has addressed a number of key gaps in the prior knowledge surrounding the certification and implementation of ISO 1400, aiming to confirm or dispute pre-existing and present discussions. Through deductive reasoning this research has provided a comprehensive investigation into the barriers and motivations experienced in its implementation. Furthermore it is has provided a comprehensive opportunity for the categorisation of organisations in relation to ISO 14001.

Beyond the academic benefits of this research it has provided opportunities for practical application within industry and policy development.

9.6.1 Specific recommendations

For Industry

The factors developed through this research process offer a number of opportunities:

- Improved marketing and sales strategies for those providing services related to ISO 14001 including accredited certification bodies and independent consultancies.
- The development of training tailored to the specific needs and motivations of the participating organisation.
- Bespoke management systems can be developed that provide extra focus on the area's most likely to cause nonconformities for specific organisations, whilst simultaneously incorporating processes that encapsulate the motivations of that organisation.
- Objectives required by ISO 14001 can be developed that best fit with the motivations and potential barriers to be faced by an individual organisation.

For Policy Development

- This information will support organisations such as local and wider government to promote the increased uptake and successes of ISO 14001.
- Through a greater understanding of the motivations and barriers potentially experienced by specific organisations, resources can be better allocated to support them in improving their chance of achieving certification to ISO 14001.
- When trying to write policy for improved environmental controls within organisations understanding their motivations will support the policy development and enhance the chances of success.

References

- ARIMURA, T. H., HIBIKI, A. and KATAYAMA, H. (2008) Is a voluntary approach an effective environmental policy instrument?: A case for environmental management systems. *Journal of Environmental Economics and Management*, 55, 281-295.
- BELTRÁN, J., MUÑUZURI, J., RIVAS, M. and GONZÁLEZ, C. (2010) Metrological management evaluation based on ISO10012: an empirical study in ISO-14001-certified Spanish companies. *Energy*, 35, 140-147.
- CAMPOS, L. M. S. (2012) Environmental management systems (EMS) for small companies: A study in Southern Brazil. *Journal of Cleaner Production*, 32, 141-148.
- CASTKA, P. and BALZAROVA, M. A. (2008) The impact of ISO 9000 and ISO 14000 on standardisation of social responsibility--an inside perspective. *International Journal of Production Economics*, 113, 74-87.
- DELMAS, M. and TOFFEL, M. (2008) Organizational responses to environmental demands: opening the black box. *Strategic Management Journal*, 29, 1027-1055.
- HERAS, I. and ARANA, G. (2010) Alternative models for environmental management in SME: the case of Ekoscan vs. ISO 14001. *Journal of Cleaner Production*, 18, 726-735.
- HILLARY, R. (2004) Environmental management systems and the smaller enterprise. *SME and Experiences with Environmental Management Systems*, 12, 561-569.
- HILLARY, R. and BURR, P. (2011) Evidence-based Study into the Benefits of EMSs for SME. DEFRA.
- JABBOUR, C. J. C. and SANTOS, F. C. A. (2006) The evolution of environmental management within organizations: Toward a common taxonomy. *Environmental Quality Management*, 16, 43-59.
- PEREZ-SANCHEZ, D., BARTON, J. R. and BOWER, D. (2003) Implementing environmental management in SME. *Corporate Social Responsibility & Environmental Management*.
- STEVENS, P. A., BATTY, W. J., LONGHURST, P. J. and DREW, G. H. (2012) A critical review of classification of organisations in relation to the voluntary implementation of environmental management systems. *Journal of environmental management*, 113, 206-212.
- WILLIAMS, H., VAN HOOYDONK, A., DINGLE, P. and ANNANDALE, D. (2000) Developing Tailored Environmental Management Systems for Small Businesses. *Eco-Management & Auditing (Wiley)*, 7, 106-113.

YIN, H. and SCHMEIDLER, P. J. (2009) Why do standardized ISO 14001 environmental management systems lead to heterogeneous environmental outcomes? *Business Strategy & the Environment* (John Wiley & Sons, Inc), 18, 469-486.

APPENDICES

Appendix A Article Published in the Journal of Environmental Management



Review

A critical review of classification of organisations in relation to the voluntary implementation of environmental management systems

Paul A. Stevens, William J. Batty, Phil J. Longhurst, Gillian H. Drew*

Centre for Energy and Resource Technology, Department of Environmental Science and Technology, School of Applied Sciences, Building 40, Cranfield University, Cranfield MK43 0AL, UK

ARTICLE INFO

Article history:

Received 17 April 2012
Received in revised form
23 August 2012
Accepted 29 August 2012
Available online

Keywords:

Environmental management
ISO 14001
Classification
Classes
Taxonomies

ABSTRACT

The need and ability of an organisation to manage and control its impact on the environment has been hotly debated in recent times. However, the uptake of certificated environmental management systems (EMS), specifically BS EN ISO 14001 (ISO 14001) (British Standards Institution, 2004), is becoming more prevalent, even though evidence of the individual benefits is less clear. Furthermore, reports are often limited and anecdotal in their discussion of the true barriers that organisations experience during the certification and management of their EMS. Presently organisations are commonly classified simply according to size and the barriers they experience when implementing an EMS successfully. This system of classification is not sufficient to understand the multifaceted environments within which modern organisations operate.

This paper reviews existing classification methodologies relevant to environmental management so as to determine whether opportunities exist for their practical application in this sector. It begins with an introduction to EMS and existing discussions regarding implementation is provided before a more detailed consideration of organisational size, the integration and development of environmental management within an organisation, then cladistics and quality management systems (QMS) are reviewed as potential opportunities for classification. This shows that whilst numerous methods are available, none function beyond the theoretical, or that the classes provided restrain the description of the complex tasks.

Central to differences faced by organisations are insights to the true hurdles that each experience when implementing an EMS. It is shown here how the manipulation of techniques from the more mature field of Energy Management may offer a direction for the development of robust classes. A valuable outcome is that these methods produce classifications that are fit for purpose to better support organisations through the implementation and management of their EMS.

© 2012 Elsevier Ltd. All rights reserved.

1. Introduction

For any company the most important factors for survival are to remain profitable, competitive and to increase market share. However, as organisations become ever more accountable for their social and environmental impact (Porter and Kramer, 2006), they must treat their operational impact on the local and wider environment as a fundamental aspect of policy design and demonstrate engagement in this through better environmental management (Aiyub et al., 2009).

Environmental management has historically taken the form of command and control regulations stemming from broad principles

or objectives introduced at international level, which have become ratified through international treaties or conventions (Brady, 2005). Whilst regulatory controls have been attributed with achieving substantial improvements in the reduction of industrial pollution they have also experienced criticism for being inflexible and not cost-effective. Consequently, the direction of control mechanisms has subsequently moved towards levies and tradable permits, but these have also been found to be inadequate for dealing with the complexities of the emissions of multiple pollutants (Ziegler and Nogareda, 2009). During recent decades these inadequacies have prompted increased development and diffusion of environmental management through the agency of private or non-governmental organisations; encouraging firms to reach beyond legislative compliance (Delmas and Toffel, 2008).

Considerable, although not uniform, agreement exists that private instruments are both beneficial and have the ability to run concurrently with existing command and control policies

* Corresponding author. Tel.: +44 (0)1234 750111; fax: +44 (0)1234 75167.
E-mail address: g.h.drew@cranfield.ac.uk (G.H. Drew).

(Alberini and Segerson, 2002; Arimura et al., 2008). Darnall (2003) suggests a combination of institutional pressures and internal competencies as explanations for firms' participation in voluntary environmental programmes, highlighting; regulatory pressure, social pressures, continual improvement capabilities and capital expenditure as motivations for the early adoption of certified Environmental Management Systems (EMS).

There has been considerable development of voluntary models for environmental management, those which go beyond legislative requirements and the pressure to undertake their implementation (Delmas and Montiel, 2008). By far the most commonly used, and so discussed, of these instruments are BS EN ISO 14001:2004 (ISO 14001) in the UK and the Environmental Management and Audit Scheme (EMAS) in Europe, with substantial levels of research attributed to their application (Delmas and Montiel, 2008; Giles, 2008; Hillary, 2004).

Many authors have discussed the perceived barriers to EMS implementation within firms, citing; the possibility of negative publicity and uncertainty over future regulatory controls (Delmas, 2000; Hillary, 2004; Fresner, 2004; Yin and Schmeidler, 2009). Additionally, and specifically in smaller firms; a lack of the required resources, including both finance and time, lack of rewards and added bureaucracy are stated as barriers to the uptake of EMS (Hillary, 2004). However, such arguments are relatively undeveloped with discussion largely based on anecdotal evidence and small scale case studies with results being used to draw general conclusions across the diverse and multifaceted environments that companies operate within.

Hunt and Auster (1990) highlighted the impact of companies' associations with negative environmental impacts, of which they include loss of competitive advantage, strained relationships with suppliers and vendors, extensive cost and loss of public image. They continue to surmise that a solution to these issues cannot be reached through a 'band aid' approach to environmental management, rather that if true and sustainable benefits are to be made then investment should be made in resource reduction management programmes.

However, even with the growth in legislative and voluntary controls, companies approach this growing challenge with diverse perspectives on the values and benefits of compliance or strategies that move beyond compliance. Companies, often of similar circumstance, vary; from those who support environmentally sound initiatives to those that avoid compliance even with existing legislation (Bansal and Roth, 2000). Paulraj (2009) discusses the need to understand the differing motives for environmental strategies and their correlation with environmental behaviour and how this often is only undertaken through 'company level' focus. Therefore, a better understanding is required of the criteria or circumstances that cause companies to display particular behavioural patterns in response to the notion of EMS. Consequently, the ability to be able to comprehensively understand the behaviours of companies in terms of business culture and structure parameters will enable the cultivation of mechanisms that support environmentally sustainable practices and help to avoid the reported barriers faced during their implementation and management within the wider company environment.

The objective of this paper is to investigate opportunities and limitations for the categorisation of organisations. It is argued that this will further understanding of the factors that influence EMS implementation, as opposed to reiterating existing discussions on EMS. More appropriate categorisation should enable specific motivations and barriers, associated with EMS, to be attributed to applicable organisations. This should allow for more resource efficient promotion, implementation and management of an individual EMS.

2. Existing methods of organisational classification

It is proposed that, to better understand the barriers to EMS implementation for the multitude of participants, broader methods of classifying companies should be employed. McKelvey (1978) offers benefits of "General Classification", as a methodology that groups objects by all their individual attributes, to include: 1) Strengthening of scientific understanding that enables homogeneous groups to be defined and subsequent hypotheses to be tested, 2) The ability to provide more comprehensive information retrieval, 3) Providing a conceptual framework capable of understanding and communicating the intrinsic diversity existing across companies, and 4) Applying classification schemes to other areas of a company including behaviour, development and practical management.

However, Goodall's (1954) paper entitled "Vegetational classification and Vegetational continua", cited in McCarthy (1995) suggests attempts at classification can result in nothing more than a waste of valuable scientific time, relating the problem to one of confusion through an inadequate understanding of the multiple taxonomical methodologies available as opposed to a fundamental desire to classify. McKelvey (1978) distinguishes taxonomy from classification as a process that not only identifies and assigns characteristics to recognised classes, but also provides a theory for the development of defined differences. Therefore if taxonomical reference is to be made in application to an understanding of the classification of firms, it is imperative that a clear and unambiguous understanding of the organisational behaviour be achieved. Furthermore, these must incorporate time series studies that of specific attributes that encompass the complexities of modern organisational culture.

2.1. Classification through organisational size

In an effort to better understand the barriers to EMS implementation, size dependant classes have been proposed. However, the division of firms is often as basic as; "Small to Medium Sized Enterprises" (SME's) and non SME's (Williams et al., 2000; Koroljova and Voronova, 2007; Heras and Arana, 2010). However, within the UK, the split between SME and non SME is shown to be 99% and 1% respectively (Department for Business Innovation and Skills, 2010).

With 99% of companies within the UK falling within the category of SME, it seems reasonable to assume that, although some similarities may exist between companies within the SME and non-SME classes, there will also be considerable differences and variations within each category in terms of the types of: business activity, organisational culture, resource availability, staff skills and challenges faced. Consequently, different requirements and expectations will be placed on the barriers faced when achieving implementation of an EMS, particularly related to the availability of different staff abilities and skills. The potential ambiguity of results obtained from the application of a limited choice of classes such as SME or non-SME, suggests that a 'one size fits all' option for effective and efficient environmental management, within such broadly define classes is neither practical nor useful. Consequently, a more discriminating classification of firms is required to support the diversities of activities, with which each company is involved, as well as the skills, qualification and motivation exhibited by the stakeholders investing in environmental management initiatives.

With such a high percentage of UK industries classified as SME's, a correlation between their financial turnovers and environmental impacts might seem inevitable, nevertheless, the complexities and the levels of correlation are still ardently debated (Yin and Schmeidler, 2009; Giles, 2008; Rowland-Jones et al., 2005). It

seems reasonable to assume that an industry and commerce category that accounts for 99.8% of all the enterprises in the European Union, 47% of total turnover and 48% of employment would also account for a substantial percentage of the overall environmental impact of firms. Pimenova and Vorst (2004) offered an estimation of the environmental impact attributable to SME's as high as 70% of the total. Although, with reference to research undertaken in six European Union countries, Pimenova and Vorst (2004) concludes that the total is more likely to be in the region of 50% bringing it in line with the relative proportions of turnover and employment of SME's. The argument for the initially higher percentage estimation was related to the impacts arising from the externalities of firms' activities and therefore not included in calculation methodologies (Kenny and Gray, 2009; Carbon Trust, 2008; DECC, 2009). It could also be argued that office floor area usage may be less dense for SME's resulting in higher environmental impacts per person in this sector. Zorpas (2010) confirms this confusion, highlighting that the heterogeneous nature of SME's makes generalisation about environmental issues very difficult.

Through a more discriminating classification of the sector more specific barriers and motivations might be discerned and understood and therefore more fitting approaches taken in both the marketing and application of EMS. Hillary (2004) highlights the inherent heterogeneity prevalent in a single category as broad as SME's thus highlighting a disparity, and possible deficit, in the knowledge required to support the mounting enthusiasm towards sustainability. Hillary (2004) concluded that future research in this field required further sub-division of the category of SME by either; size or by industry sector. However, no explanations for these specific choices of classes are discussed or reasoning for their pre-eminence provided.

Zorpas (2010) expanded on the work of Hillary (2004) by undertaking a detailed analysis of EMS for SME's and very small to medium enterprises (VSME), based on the European Union's (2005) SME definition. The research endeavours to distinguish the different needs, wants and stimuli for EMS implementation in SME's and the subcategory of VSME. Zorpas (2010) hypothesised that VSME's often provided mono-service or product offerings and that they were disproportionately affected, in a negative manner, by economic pressures. Additionally, it was suggested that the responses of VSME to new requirements of the market were restricted through little access to further training; non participate in knowledge transfer or developing cross firm federation whilst producing high levels of waste (Zorpas et al., 2008). However, contradictory research suggests that SME's experience distinct advantages over non-SME's when implementing green initiatives including less bureaucracy, quicker response time and efficient internal communication (Van Hemel and Cramer, 2002). This debate highlights the inefficiencies of organisational classes such as size for categorising firms. If the classes developed are unrepresentative of actual activities the resulting classification will also be unrepresentative of the barriers and benefits experienced by participating firms.

Separate research within this field has approached the understanding of SME's and EMS implementation in terms of its integration within an organisation, by focussing on the motivations driving the process and attempting to offer a classification methodology based on this (Paulraj, 2009; Jabbour and Santos, 2006).

2.2. Classification based on stages of integration, development and evolution

Jabbour and Santos (2006) discussed environmental management classification as a taxonomical study that is not size dependant but rather related to the achieving of a "stage" within an

evolutionary process dependant on the level to which environmental strategies and actions are integrated within a particular organisation. Jabbour and Santos (2006) summarised this research and propose taxon comprising of three evolutionary stages of environmental management; (i) functional specialisation, (ii) internal integration and (iii) external (or strategic) integration. Jabbour and Santos (2006) suggested that each taxon draws together several criteria for defining the environmental management maturity that may be present within a firm and proposed that the level of maturity found within firms ultimately correlates with a firm's overall organisational configuration. However, as with the classification of companies by size; SME, small enterprise (SE) and very small enterprise (VSE) this taxonomy only provides three options within which to place all firms and with very broad criteria for inclusion. It must be questioned whether such broad classes (taxa) would be able to provide sufficiently clear discrimination between participants.

Jabbour and Santos (2006) bases much of the conclusions drawn from their study on an investigation of 37 firms that had achieved certification to ISO 14001, implying that all of these firms had a degree of understanding and commitment to improvements in environmental management. However, Jabbour and Santos (2006) states that these firms still demonstrated discrete behaviours, suggesting that these could be attributed to specific organisational contexts. This heterogeneity is a phenomenon that has been neglected in current literature and Yin and Schmeidler (2009) state that, due to the 'standardised' nature of management systems they are often linked with a perception of homogeneity that encourages unrealistic conclusions being drawn as to the similarity of the processes or structures of one organisation to those of another (isomorphism). Furthermore, it raises the question as to whether the scope of the conclusions reached by Jabbour and Santos (2006), for companies that have achieved ISO 14001 certification, can be expanded to include companies that have yet to, or have no intention of, acquiring certification to ISO 14001. Including such companies within a limited "evolutionary" matrix may impact on the usefulness of the proposed taxonomy, especially when existing variations in behavioural patterns are taken into account. This implies a need for a wider research base and for a greater number of relevant classes (taxa) to be considered. Paulraj (2009) strengthens this argument through concluding that the research undertaken to date had been modest and based on "a parsimonious set of motivational indicators". Therefore, Paulraj (2009) determines that future research is required that not only refines and strengthens the identified constructs, but also expands both the theoretical and empirical bases of future research through the use of additional motivational indicators and a broader set of descriptive variables.

2.3. Classification through the use of cladistics

It has been suggested that an organisation's approach to EMS implementation can have a direct impact on the internal development of the scheme (Yin and Schmeidler, 2009) and overly simplistic classification may ignore the heterogeneous nature of organisations (Hillary, 2004). Therefore a more comprehensive process of defining classes that incorporates behavioural aspects of an organisation should be established in relation to environmental management systems. McKelvey (1978) suggests that systematics have the potential to dramatically improve the understanding of organisations. This is where the complete system is considered in order to understand differences and their relationships with the wider environment. Subsequently, this process can provide a meaningful method of classification. He cites significant similarities between organisations and organisms. Systematics include three main components: (i) Taxonomy – the construction of

defined organisational distinctions; (ii) evolution – the mapping of the ancestry of biological the distinctions and (iii) classification – the implementation of processes that enable organisational forms to be placed into classes. However, McKelvey (1978) stated that organisational systematics required both numerical taxonomic and phyletic theories of classification, which are explained in detail in McKelvey (1978).

However, McKelvey (1978) also suggests that focussing on only one or two attributes of an organisation may offer high predictive validity but only in relation to the prescribed areas of organisational behaviour, entitling this “Special Classification”. Therefore, special classification is only beneficial if the attribute(s) included are the point of focus and offers poor mechanisms for retrieval and understanding of the relationships between wider organisational behaviours. That is to say where a functional study uses taxa based on size it may be difficult to transpose this knowledge to taxa relating to age, bureaucracy or complexity within organisations (McKelvey, 1978).

McCarthy (1995) incorporated the work of McKelvey (1978) to consider the application of the concepts of organisational systematics and biological taxonomy in an attempt to classify firms within the manufacturing sector. McCarthy (1995) discusses the notions of numerical, essentialistic, nominalistic and cladistic theories as methodologies for the development of taxa to be used for such classifications. Cladistics, although originating in the classification of languages and then migrating into biological evolutionary theory, has become embedded in attempts to make classifications within the manufacturing sector (Leseure, 2002). Leseure (2002) suggested that cladistics was initially deemed “lowbrow” by evolutionary biologists in comparison to phenetics, a quantitative classification technique based on the use of cluster analysis. Cladistics, a systematisation technique, allows “specimens” to be grouped into systems and because of this “cladistics can be applied to study the history of any evolving system: the evolution of management ideas, of beliefs, of products, of technologies, etc.” (Leseure, 2002). McCarthy et al. (2000) suggested that cladistics is the dominant approach in biology and therefore the most suitable tool for classification of manufacturing companies. Leseure (2002), supported this conclusion, suggesting that cladistics, rather than phenetics was the most applicable tool within this field.

McCarthy (1995) shows that cladistics, through their wider application, have developed a set of rules and principles. These rules are concerned with operational principles, such as branching and labelling. It is suggested that these rules are transferable to operational principles of other industries and systems, specifically manufacturing. However McCarthy (1995), although offering a schematic of a dendrogram, does this only in an explanatory context, as opposed to one capable of practical application. McCarthy (1995) concludes that a relatively precise, stable, enduring and universal classification could be achieved and that this would significantly improve understanding of, in this instance, manufacturing company systems. Furthermore, McCarthy (1995) considers that this methodology may increase the accuracy and value of predictions which would subsequently bring about ‘ideal’ category specific models and solutions.

However, although the practice of cladistics enables multiple taxa and the resulting expansion of classes beyond those found when using industry size and type alone, it does have limitations and is not without detractors. The processes have been described as post-hoc with limitations specifically related to future decision making processes or evolutionary trajectories such as the implementation of innovative technologies and advanced systems (Baldwin et al., 2005). In this context, post-hoc analyses are concerned with finding patterns and/or relationships between subgroups of sampled populations that would otherwise remain

undetected were the investigators to have to rely strictly upon a-priori statistical methods. Such analyses form a valuable collection of tools which allow exploratory research greater freedom. McCarthy (1995) highlighted that the essential attributes of taxa should be appropriate, with reference in his paper to the manufacturing sector. In this instance the development of taxa had been made in reference to the classification of firms and considered a number of factors which must be:

- Mutually exclusive – taxa must not allow for a firm's inclusion in more than one category:
- Internally homogeneous – certain discrete behaviour must be excluded during classification:
- Collectively exhaustive – taxa provided must ensure complete inclusion of all participating firms:
- Stable – further empirical tests of firms should not affect the predetermined taxa:
- Relevant in terms of naming – to ensure effective communication naming of taxa should be based on common academic and business language (McCarthy, 1995).

Furthermore, Leseure (2002), McCarthy (1995) and McCarthy et al. (2000), although providing eloquent arguments supporting the benefits of cladistics, did so from a very fundamental stand point. They do not provide either empirical evidence of application or the methodology used to achieve the conclusions drawn. Furthermore, no empirical evidence was provided to support their theory that classification can aid a decision making process was lacking. The link between theory and practical application of this argument is missing, as is the inclusion of constraints for the construction of robust taxa. It is implied but not explicitly explained by the authors, that cladistics can provide a classification system based on an evolutionary process. Additionally, cladistic analysis has been defined, by Lipscomb (1998), as providing “relative statements of relationship” rather than being capable of “explicitly hypothesising ancestor–descendent relationships” (Lipscomb, 1998).

2.4. Classification related to the concepts of quality management

A further opportunity to expand the classes used when categorising firms in relation to their environmental management is their integration with practices more usually discussed within the context of quality management. This link has been keenly discussed in relation to ISO 14001 and the quality management system (QMS) BS EN ISO 9001:2000/2008 (ISO 9001) (Zeng et al., 2005; Castka and Balzarova, 2008; Tarí and Molina-Azorín, 2010). Zeng et al. (2005) showed that the term integration itself has multiple definitions and that although not necessarily contradictory these terms do focus on specific characteristics that therefore alter the meaning of the word in discrete contexts.

Gavin (1991) focuses on integration in relation to the ability to offer synchronisation and unity within an organisation, whereas MacGregor Associates (1996) see integration as a singular, top level, standard capable of supporting modular attachments for specific requirements. This complicates the work of authors such as Jabbour and Santos (2006), who provide a classification process based on ‘integration’ to evaluate environmental management and to develop a supporting classification of companies. Furthermore the methods foundation is in reviews of existing research as opposed to empirical trials that would suggest an opportunity for practical application. Additionally, due to the very limited classes offered (3) the process does not promote integration as a classification process over other discriminatory behaviours.

This is not to say that the environmental management and its integration with quality management cannot support the

development of classes that benefit the understanding, and subsequent ability to offer a beneficial service to SME's. Using the requirements of ISO 14001 and ISO 9001 (Annex B of ISO 14001 and Annex A of ISO 9001) (British Standards Institution, 2004; British Standards Institution, 2008), the internationally recognised and extensively adopted EMS and QMS (Zeng et al., 2005) highlight that opportunities for integration are clear with every specific requirement of ISO 14001 having a direct link to the similar requirements within ISO 9001.

This review of ISO 14001 Annex B (British Standards Institution, 2004) also highlights another simplification in the available classes and may go some way to explain the discrete behaviours shown by companies attempting to attain certification. Within most of the relevant literature, ISO 14001 is discussed as a single standard and not in terms of its multiple requirements to which firms must comply for certified compliance (Hillary, 2004; Zorpas, 2010; Giles, 2008; Yin and Schmeidler, 2009). It has been clearly shown that different firms approach ISO 14001 implementation and management differently (Yin and Schmeidler, 2009; Hillary, 2004; Fresner, 2004), therefore it can be concluded that firms will approach and integrate individual challenges discreetly too. Consequently a more comprehensive classification methodology might be able to incorporate these behavioural attributes more readily.

3. Future opportunities for classification

Lessons in classification may also be learnt through the investigation of energy management, a longer studied and more mature research field that offers considerable similarities with the current interests in environmental management. The use of ISO standards in applicable disciplines clearly shows a significant link in the requirements of both energy and environmental management (British Standards Institution, 2011). It may then be concluded that lessons already learnt in the field of energy management may be both applicable and beneficial in avoiding wasted effort through the "reinvention of the wheel", in research into the uptake of EMS.

Instead of attempting to channel firms and their discreet attributes into pre-determined and confining classes reliant on perceived similarities, a more logical process would be to develop an understanding of both the similarities and differences present. Fawkes (1987) proposed aspects of company structure, resource base and character that potentially allow a move away from a limited approach to classification by offering the "Seven S Approach". In this approach he considered the description of company organisation and culture in terms of 7 classes as follows:

- *Superordinate goals*: the guiding concepts instilled by an organisation in its members.
- *Strategy*: the process by which an organisation allocates its finite resources to achieve desired outcomes.
- *Structure*: the characteristics of the organisation's structure.
- *Systems*: proceduralised processes.
- *Skills*: possessed by either individuals, groups or the firm as a whole.
- *Style*: the behaviour and characteristics of key managers in the implementation of organisational goals as well as the organisational culture.
- *Staff*: the breakdown of significant employee classes (Fawkes, 1987).

Although the Seven S's concept was intended to allow behaviours of companies to be differentiated, this methodology also provides an opportunity to categorise aspects of company behaviour. An example of this is provided when Western and Japanese management styles are compared and their differences highlighted

using the Seven S factors (Pascale and Athos, 1982). This work provides a set of classes that allow discreet behavioural patterns to be identified. The Seven S system will allow the inclusion of the previously discussed classification methods (Fig. 1), to develop a methodology for studying the behaviours of firms in relation to environmental, energy or quality management requirements.

To move from providing the theoretical basis for research to the development of a practical methodology, the Seven S model requires a structured platform to enable its application. Existing techniques from the energy sector may be able to provide this structure in the form of the well established notion of the Energy Management Matrix (BRECSU). This tool, in its original guise, acted as an effective method of increasing the understanding of a company's energy management philosophy and practice (Ashford, 1993).

The matrix columns deal, individually, with areas pertinent to energy management and the rows offer qualitative descriptions of increasingly sophisticated controls for these. The use of this matrix suggests that through the application of Fawkes (1987) model it may be possible to bridge the existing gap between a theoretical basis for classification and a practical methodology.

4. Discussion

Research surrounding EMS and its impact on companies is extensive and clearly highlights a growing pressure on them to incorporate green controls within their operational procedures. The evidence that different firms approach and experience EMS implementation and management differently remains mostly anecdotal and has been derived from research where these aspects were of secondary concern to the purpose of the studies.

Additionally, reported notions concerned with methods of classification, particularly in relation to EMS appear to be either convoluted or overly simplistic in terms of the taxa proposed. Proposed approaches focus on only a small aspect of company behaviours in response to environmental management and so require companies to be 'shoe horned' into classes that subsequently are unable to allow the discreet behaviours they may exhibit to be distinguished. Rather existing research, including that of Hillary (2004), Koroljova and Voronova (2007), Heras and Arana (2010) and Yin and Schmeidler (2009), highlights the need to better understand the heterogeneity inherent within smaller enterprises and the need to understand these in terms of barriers to EMS implementation. However to date, research has not provided either encompassing sets of classes or proposed methods capable of converting theory into applicable methods from which conclusions might be drawn.

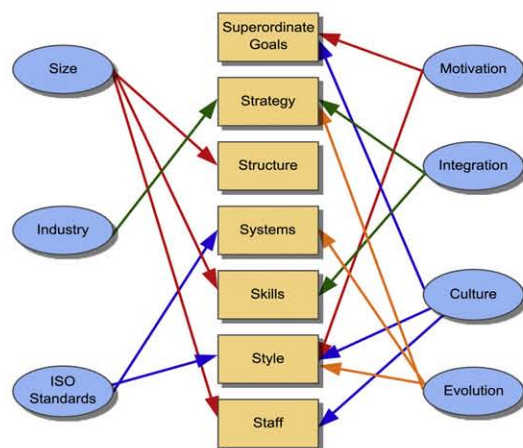


Fig. 1. The Seven S model and the correlation with discussed categories.

Previous research has discussed the reasoning for EMS implementation in terms of motivations driving the process, even attempting to categorise firms by this (Paulraj, 2009; Jabbour and Santos, 2006). However, the need for research to encompass the requirements of differing firms and their wish to achieve different outcomes beyond simple compliance to an EMS has mostly been neglected. Different aspects of ISO 14001 are likely to be given different weightings by companies and so resources will be allocated accordingly. This important aspect of company behaviour has not been factored into any of the classification methodologies proposed to date.

Confusion is compounded by the seemingly interchangeable use of the terms classification and taxonomy. If research does not encompass detailed information surrounding organisational evolution and behaviour and is not based on time series studies it is unable to provide taxa. Consequently the term classification is more accurate when discussing existing research.

Potential exists for research into the implementation of EMS to learn from more established areas such as energy management. Concepts such as the Seven S model and energy management matrices may enable more appropriate and discriminating classes to be defined that offer meaningful and applicable methods of classification. To further research in this field a comprehensive and structured understanding of the discrete behaviours exhibited by companies is required to support the development of a more extensive set of classes. It is proposed, that robust classes may be identified that encompass and integrate multiple parameters of service based systems and that these should be used rather than restrictive sets of classes drawn from a limited view of the field of study. It is also necessary to incorporate the diversity prevalent in organisations that may presently portray similar characteristics when existing taxa are employed and with particular reference to EMS allow for the different motivations for pursuing certification.

For some of the more complex methods of classification there has been a lack of practical application. Cladistics, although developed from a sound academic base, has yet to be proven in the context of environmental management. Furthermore, the variety of research combined with the lack of application has lead to a diverse group of methodologies that, in turn, create confusion for future research or application and a fundamentally limited understanding of the notion of taxonomy.

To overcome this hurdle it is proposed that consideration is given to research previously carried out under the title of “Energy Management”. Energy management, being extensively developed since the late 1970s, offers transferable knowledge, techniques and skills. It has also been shown that there are considerable similarities between a number of standards including quality, energy and environmental management standards BS EN ISO 50001:2011, ISO 9001 and ISO 14001 respectively. As such it may be possible to apply lessons learnt in the context of any one of these standards to organisations that operate certification to the other standards.

Furthermore, Fawkes’ (1987) notion of seven classes within which companies may be described when incorporated with attributes such as size and activity type provides a basis for a method of developing taxa that will enable an understanding of both the similarities and differences present in company behaviours as related to certification and application of EMS. Through the use of the proposed model it may be possible to bridge the existing gap between a theoretical basis for classification and a practical methodology.

5. Conclusions

It can be seen that there are significant gaps in our current understanding of the heterogeneity of organisational responses to

EMS implementation. Discussion to date has often been based on opinion and anecdote as opposed to evidence. Furthermore, it is clear that there is a requirement for a robust process of categorisation that incorporates behavioural, as opposed to standard metrics for organisations. Such an approach would inform EMS implementation where understanding of the internal process can then be achieved. The key conclusions of this work are:

- An inherent lack of understanding exists regarding the true barriers to the practises involved in the certification and implementation of an EMS.
- The division of firms is often as simple as Small to Medium Sized Enterprises” (SME’s) and non SME’s and this does not support the improvement of the certification process.
- No clear basis exists currently for the development of relevant classification processes.
- The process of classification is often confused through the use of multiple methodologies and a limited understanding of the notion of taxonomy.
- The placing of firms in to groups based upon very broad criteria does not necessarily provide clear discrimination between participants.
- Classification methods such as cladistics, although developed from sound academic bases, are yet to prove their value for practical application in relation to EMS.
- Existing methods of classification neglect to encompass the different requirements of firms and their wish to achieve different outcomes beyond simple compliance to an EMS
- The 7S model potentially provides a basis for developing taxa that better support the understanding of both the similarities and differences present in company behaviours as related to certification and application of EMS.
- It is suggested that the 7S model for company organisational behaviours will help to bridge the existing gap between the theoretical basis for classification and a practical methodology.

References

- Aiyub, K., Jaji, J.M., Arifin, K., Awang, A., 2009. Environmental performance in small and medium sized enterprises (SMEs) certified to ISO 14001 in the United Kingdom. *International Business Management* 3, 7.
- Alberini, A., Segerson, K., 2002. Assessing Voluntary Programs to Improve Environmental Quality.
- Arimura, T.H., Hibiki, A., Katayama, H., 2008. Is a voluntary approach an effective environmental policy instrument?: a case for environmental management systems. *Journal of Environmental Economics and Management* 55, 281–295.
- Ashford, C.J., 1993. Energy efficiency: a managed resource. *Facilities* 11, 24–27.
- Baldwin, J., Allen, P.M., Ridgway, K., Winder, B., 2005. Evolutionary systems: modelling organisational innovation. *Innovation: Management, Policy & Practice* 7, 389–401.
- Bansal, P., Roth, K., 2000. Why companies go green: a model of ecological responsiveness. *The Academy of Management Journal* 43, 19.
- Brady, J., 2005. *Environmental Management in Organizations the Iema Handbook*. Earthscan, Bath.
- British Standards Institution, 2004. BS EN ISO 14001:2004 Environmental Management Systems Requirements with Guidance for Use.
- British Standards Institution, 2008. BS EN ISO 9001:2008 Quality Management Systems Requirements. BSI.
- British Standards Institution, 2011. BS ISO 50001:2011 Energy Management System. BSI Standards Publication.
- Carbon Trust, 2008. *Carbon Footprinting: an Introduction for Organisations*. Carbon Trust.
- Castka, P., Balzarova, M.A., 2008. The impact of ISO 9000 and ISO 14000 on standardisation of social responsibility – an inside perspective. *International Journal of Production Economics* 113, 74–87.
- DECC, 2009. UK’s National Strategy for Climate and Energy: Transition to a Low Carbon Society. In: Department for Energy and Climate Change, UK.
- Darnall, N., 2003. Why firms certify to ISO 14001: an institutional and resource-based view. In: Nagao, D. (Ed.), *Best Paper Proceedings: Sixty-First Meeting Of The Academy Of Management*. Academy of Management.
- Delmas, M., 2000. Barriers and incentives to the adoption of ISO 14001 in the United States. *Duke Environmental Law and Policy Forum* Fall 1, 38.

- Delmas, M., Montiel, I., 2008. The diffusion of voluntary international management standards: responsible care, ISO 9000, and ISO 14001 in the chemical industry. *Policy Studies Journal* 36 (1), 65–93.
- Delmas, M., Toffel, M., 2008. Organizational responses to environmental demands: opening the black box. *Strategic Management Journal* 29, 1027–1055.
- Department for Business Innovation and Skills, 2010, 09/06/11. Enterprise Directorate: Small and Medium Enterprise Statistics for the UK and Regions. Retrieved 09/06/11, 2011, From <http://stats.bis.gov.uk/ed/sme/>.
- European Union, 2005. The New SME Definition User Guide and Model Declaration. Fawkes, S.D., 1987. The seven S approach to energy management. *Applied Energy* 28, 235–242.
- Fresner, J., 2004. Small and medium sized enterprises and experiences with environmental management. *Journal of Cleaner Production* 12, 545–547.
- Gavin, D., 1991. How the Baldrige award really works. *Harvard Business Review*, 80–93.
- Giles, F., 2008. Assessing the effectiveness of your environmental management system. *Environmental Quality Management* 18, 1–6.
- Goodall, D.W., 1954. Vegetational Classification and Vegetational Continua, vol. 1. *Angew. Pflanz (Wien) Festsch. Aich*, pp. 168–182.
- Heras, I., Arana, G., 2010. Alternative models for environmental management in SMEs: the case of Ekoscan vs. ISO 14001. *Journal of Cleaner Production* 18, 726–735.
- Hillary, R., 2004. Environmental management systems and the smaller enterprise. SME's and Experiences with Environmental Management Systems 12, 561–569.
- Hunt, C.B., Auster, E.R., 1990. Proactive environmental management: avoiding the toxic trap. *Sloan Management Review* 31, 7.
- Jabbour, C.J.C., Santos, F.C.A., 2006. The evolution of environmental management within organizations: toward a common taxonomy. *Environmental Quality Management* 16, 43–59.
- Kenny, T., Gray, N.F., 2009. Comparative performance of six carbon footprint models for use in Ireland. *Environmental Impact Assessment Review* 29 (1), 1–6.
- Koroljova, A., Voronova, V., 2007. Eco-mapping as a basis for environmental management systems integration at small and medium enterprises. *Management of Environmental Quality: An International Journal* 18, 542–555.
- Leseure, M.J., 2002. Cladistics as historiography: part I – introduction to cladistics. *Management Decision* 40, 486–496.
- Lipscomb, D., 1998. Basics of Cladistics. Distributed by the author, www.gwu.edu/~clade/faculty/lipscomb/Cladistics.pdf.
- Macgregor Associates, 1996. Study on Management System Standards. British Institute, London.
- McCarthy, 1995. Manufacturing classification: lessons from organizational systematics and biological taxonomy. *Integrated Manufacturing Systems* 6, 37–48.
- McCarthy, I., Ridgway, K., Leseure, M., Fieller, N., 2000. Organisational diversity, evolution and cladistic classifications. *Omega* 28, 77–95.
- McKelvey, B., 1978. Organizational systematics: taxonomic lessons from biology. *Management Science* 24, 1428.
- Pascale, R.T., Athos, A.G., 1982. *The Art of Japanese Management*. Penguin, London.
- Paulraj, A., 2009. Environmental motivations: a classification scheme and its impact on environmental strategies and practices. *Business Strategy & the Environment* (John Wiley & Sons, Inc) 18, 453–468.
- Pimenova, P., Vorst, V.D.R., 2004. The role of support programmes and policies in improving SMEs environmental performance in developed and transition economies. SME's and Experiences with Environmental Management Systems 12, 549–559.
- Porter, M.E., Kramer, M.R., 2006. Strategy & society: the link between competitive advantage and corporate social responsibility. *Harvard Business Review* 84, 78–92.
- Rowland-Jones, R., Pryde, M., Cresser, M., 2005. An evaluation of current environmental management systems as indicators of environmental performance. *Management of Environmental Quality* 16, 211.
- Tari, J.J., Molina-Azorin, J.F., 2010. Integration of quality management and environmental management systems similarities and the role of the EFQM model. *TQM Journal* 22, 687–701.
- Van Hemel, C., Cramer, J., 2002. Barriers and stimuli for ecodesign in SMEs. *Journal of Cleaner Production* 10, 439–453.
- Williams, H., Van Hooydonk, A., Dingle, P., Annandale, D., 2000. Developing tailored environmental management systems for small businesses. *Eco-Management & Auditing* (Wiley) 7, 106–113.
- Yin, H., Schmeidler, P.J., 2009. Why do standardized ISO 14001 environmental management systems lead to heterogeneous environmental outcomes? *Business Strategy & the Environment* (John Wiley & Sons, Inc) 18, 469–486.
- Zeng, S.X., Tian, P., Shi, J.J., 2005. Implementing integration of ISO 9001 and ISO 14001 for construction. *Managerial Auditing Journal* 20, 394–407.
- Ziegler, A., Nogareda, J.S., 2009. Environmental management systems and technological environmental innovations: exploring the causal relationship. *Research Policy* 38, 885–893.
- Zorpas, A., 2010. Environmental management systems as sustainable tools in the way of life for the SMEs and VSMES. *Bioresource Technology* 101, 1544–1557.
- Zorpas, A.A., Tsartas, P., Aristidis, G., Theoharous, O., 2008. Mediterranean standard for sustainable tourism (MESST) – general requirements, objectives and the philosophy of MESST. Sustainable Tourism, Wessex Institute of Technology 3.

Appendix B SGS Client Questionnaire



Cranfield project

Created: November 24 2011, 5:19 AM
Last Modified: November 24 2011, 8:50 AM
Design Theme: Blue Horizon
Language: English
Button Options: Custom: Start Survey: "Start Survey!" Submit: "Submit"
Disable Browser "Back" Button: False

Page 1 - Question 1 - Name and Address (U.S.)

Some information about you and your organisation.

- ☐ Job Title?
- ☐ Number of years in that position?
- ☐ Main industry sector operated in?
- ☐ Total number of employees at your organisation?
- ☐ Number of years ISO 14001 certification held?
- ☐ Organisation reference number (To be completed by SGS)

Page 1 - Question 2 - Rating Scale - Matrix

The goals of the organisation are clearly communicated to all employees.

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
Enter an answer	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5
<input type="checkbox"/> Any further comment?					

Page 1 - Question 3 - Ranking Question

To what extent did each of the following drivers influence your decision to implement ISO 14001?

Instruction from head office	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5	<input type="radio"/> 6
Availability of grants	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5	<input type="radio"/> 6
Pressure from regulators	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5	<input type="radio"/> 6
Pressure from customers/clients	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5	<input type="radio"/> 6
Reduce exposure to legislative noncompliance	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5	<input type="radio"/> 6
Financial return	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5	<input type="radio"/> 6

Page 1 - Question 4 - Ranking Question

To what extent do the following aspects motivate you to maintain your certification to ISO 14001?

Increase profit (for commercial organisations)	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5	<input type="radio"/> 6	<input type="radio"/> 7	<input type="radio"/> 8	<input type="radio"/> 9	<input type="radio"/> 10
Improve customer service	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5	<input type="radio"/> 6	<input type="radio"/> 7	<input type="radio"/> 8	<input type="radio"/> 9	<input type="radio"/> 10
Develop good communications with staff and customers	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5	<input type="radio"/> 6	<input type="radio"/> 7	<input type="radio"/> 8	<input type="radio"/> 9	<input type="radio"/> 10
Enhance efficient work practices	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5	<input type="radio"/> 6	<input type="radio"/> 7	<input type="radio"/> 8	<input type="radio"/> 9	<input type="radio"/> 10

										10
Enhance a good reputation	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5	<input type="radio"/> 6	<input type="radio"/> 7	<input type="radio"/> 8	<input type="radio"/> 9	<input type="radio"/> 10
Implement good decision-making practices	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5	<input type="radio"/> 6	<input type="radio"/> 7	<input type="radio"/> 8	<input type="radio"/> 9	<input type="radio"/> 10
Reduce the organisation's environmental impact	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5	<input type="radio"/> 6	<input type="radio"/> 7	<input type="radio"/> 8	<input type="radio"/> 9	<input type="radio"/> 10
Improve staff morale	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5	<input type="radio"/> 6	<input type="radio"/> 7	<input type="radio"/> 8	<input type="radio"/> 9	<input type="radio"/> 10
Provide quality products/service	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5	<input type="radio"/> 6	<input type="radio"/> 7	<input type="radio"/> 8	<input type="radio"/> 9	<input type="radio"/> 10
Support inexpensive but reliable products	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5	<input type="radio"/> 6	<input type="radio"/> 7	<input type="radio"/> 8	<input type="radio"/> 9	<input type="radio"/> 10

Page 1 - Question 5 - Rating Scale - Matrix

Since the initial decision to implement ISO 14001 was made it has become more fundamental to the organisations business development?

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
Enter an answer	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5
 Any further comment?					

Page 1 - Question 6 - Rating Scale - Matrix

The implementation of the Environmental Management System (EMS) has been of significant value in terms of:

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
Financial return/savings	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5
Improved public perception	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5
Development of new business	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5
Retention of existing customers	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5
Improved efficiencies of internal processes	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5
More secure subcontractor controls	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5
Marketability of certification	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5
Reduced impact on the environment	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5
Higher staff motivation	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5
Better environmental controls	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5
Increased confidence regarding environmental legislation	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5

Page 1 - Question 7 - Rating Scale - Matrix

What aspects of your EMS do you believe are most likely to cause nonconformities?

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
Policy design	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5
Defining your aspects and impacts	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5
Compiling the legal register	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5
Ensuring legal compliance	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5
Setting objectives	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5
Communicating the requirements of the EMS	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5

Ensuring training and awareness is sufficient	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5
Managing the required documents	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5
Controlling the emergency preparedness procedures	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5
Carrying out audits	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5
Management Review	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5

Page 1 - Question 8 - Open Ended - Comments Box

Does your organisation maintain certification to other standards? If so which ones?

Page 1 - Question 9 - Rating Scale - Matrix

Our organisation integrates its policy and procedures for multiple standards.

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
Enter an answer	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5
 Any further comment?					


Page 1 - Question 10 - Rating Scale - Matrix

Sufficient resources were allocated to the implementation of ISO 14001.

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
Enter an answer	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5
 Any further comment?					

Page 1 - Question 11 - Rating Scale - Matrix

Our organisation maintains ISO 14001 as part of a wider Corporate Social Responsibility strategy.

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
Enter an answer	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5
 Any further comment?					

Page 1 - Question 12 - Rating Scale - Matrix

External consultancy was most beneficial:

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
In developing the manual and operational procedures	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5
Prior to the stage 1 assessment	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5
Prior to the stage 2 assessment	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5
With the ongoing management and improvement of the system	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5
With ongoing training	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5

Page 1 - Question 13 - Choice - One Answer (Bullets)

The organisation communicates the outcomes of the EMS internally via (Please select those that apply):

- ☐ E-mails
- ☐ The internet
- ☐ Team meetings with minutes
- ☐ Specific training sessions
- ☐ Induction training
- ☐ As part of a documented wider body of training and ongoing personal development.
- ☐ One to one training
- ☐ Via news letters
- ☐ Other, please specify

Page 1 - Question 14 - Rating Scale - Matrix

Our EMS is integrated with existing processes and procedures e.g. setting of objective and/or purchasing.

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
Enter an answer	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5
Any further comment?					

Page 1 - Question 15 - Rating Scale - Matrix

If your organisation undertakes any of the following, how often?

	Daily	Weekly	Monthly	Biannually	Annually	N/A
Board meetings	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Interdepartmental Meetings	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Departmental Meetings	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Team meetings	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Focus groups	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Green groups	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Informal meetings	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Opportunities for open discussion	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Page 1 - Question 16 - Rating Scale - Matrix

Can employees access information relevant to ISO 14001 via:

	Yes	No	N/A
E-mails	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> N/A
The internet	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> N/A
Team meetings with minutes	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> N/A
Specific training sessions	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> N/A
Induction training	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> N/A
As part of a documented wider body of training and ongoing personal development	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> N/A
One to one training	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> N/A
Via news letters	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> N/A

Page 1 - Question 17 - Ranking Question

Please rank the following in order of difficulty caused in relation to ISO 14001:

Policy design	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5	<input type="radio"/> 6	<input type="radio"/> 7	<input type="radio"/> 8	<input type="radio"/> 9	<input type="radio"/> 10	<input type="radio"/> 11
Identifying your aspects and impacts	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5	<input type="radio"/> 6	<input type="radio"/> 7	<input type="radio"/> 8	<input type="radio"/> 9	<input type="radio"/> 10	<input type="radio"/> 11
Compiling the legal register	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5	<input type="radio"/> 6	<input type="radio"/> 7	<input type="radio"/> 8	<input type="radio"/> 9	<input type="radio"/> 10	<input type="radio"/> 11
Ensuring compliance to the legal register	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5	<input type="radio"/> 6	<input type="radio"/> 7	<input type="radio"/> 8	<input type="radio"/> 9	<input type="radio"/> 10	<input type="radio"/> 11
Setting and achieving objectives	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5	<input type="radio"/> 6	<input type="radio"/> 7	<input type="radio"/> 8	<input type="radio"/> 9	<input type="radio"/> 10	<input type="radio"/> 11
Communicating the requirements of the EMS	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5	<input type="radio"/> 6	<input type="radio"/> 7	<input type="radio"/> 8	<input type="radio"/> 9	<input type="radio"/> 10	<input type="radio"/> 11
Ensuring training and awareness is sufficient	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5	<input type="radio"/> 6	<input type="radio"/> 7	<input type="radio"/> 8	<input type="radio"/> 9	<input type="radio"/> 10	<input type="radio"/> 11
Managing the required documents	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5	<input type="radio"/> 6	<input type="radio"/> 7	<input type="radio"/> 8	<input type="radio"/> 9	<input type="radio"/> 10	<input type="radio"/> 11
Controlling the emergency preparedness procedures	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5	<input type="radio"/> 6	<input type="radio"/> 7	<input type="radio"/> 8	<input type="radio"/> 9	<input type="radio"/> 10	<input type="radio"/> 11
Carrying out audits	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5	<input type="radio"/> 6	<input type="radio"/> 7	<input type="radio"/> 8	<input type="radio"/> 9	<input type="radio"/> 10	<input type="radio"/> 11
Management review	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5	<input type="radio"/> 6	<input type="radio"/> 7	<input type="radio"/> 8	<input type="radio"/> 9	<input type="radio"/> 10	<input type="radio"/> 11

Page 1 - Question 18 - Rating Scale - Matrix

The budgeted cost of ISO 14001 implementation was sufficient to achieve certification		
Yes	No	Don't know
<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3

Page 1 - Question 19 - Rating Scale - Matrix

ISO 14001 was financially beneficial in terms of:					
	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
Business development	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5
Business retention	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5
Energy efficiency	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5
Water efficiency	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5
Waste	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5
Processes efficiency	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5

Page 1 - Question 20 - Rating Scale - Matrix

Do you feel the performance of your EMS has improved other aspects of performance in relation to:			
	Yes	No	Don't know
Business development	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Business retention	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Energy efficiency	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Water efficiency	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Waste	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Processes efficiency	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Page 1 - Question 21 - Rating Scale - Matrix

Initially our organisation was lacking the required skills to implement ISO 14001.					
	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
Any further comment	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5
Enter an answer					

Page 2 - Question 22 - Choice - Multiple Answers (Bullets)

Experience and available skill sets in "Environmental Management" where beneficial during these stages of ISO 14001 certification (Please select as many or as few options as you wish):

- ☐ Before Certification
- ☐ During Certification
- ☐ After Certification
- ☐ We do not have experience or skills in this area

Page 2 - Question 23 - Choice - Multiple Answers (Bullets)

Experience and available skill sets in "Project Management" where beneficial during these stages of ISO 14001 certification (Please select as many or as few options as you wish):

- ☐ Before Certification
- ☐ During Certification
- ☐ After Certification
- ☐ We do not have experience or skills in this area

Page 2 - Question 24 - Choice - Multiple Answers (Bullets)

Experience and available skill sets in "Information Technology" where beneficial during these stages of ISO 14001 certification (Please select as many or as few options as you wish):

- ☐ Before Certification
- ☐ During Certification
- ☐ After Certification
- ☐ We do not have experience or skills in this area

Page 2 - Question 25 - Choice - Multiple Answers (Bullets)

Experience and available skill sets in "Legal and regulatory compliance" where beneficial during these stages of ISO 14001 certification (Please select as many or as few options as you wish):

- ☐ Before Certification
- ☐ During Certification
- ☐ After Certification
- ☐ We do not have experience or skills in this area

Page 2 - Question 26 - Choice - Multiple Answers (Bullets)

Experience and available skill sets in "Relating to other standards" where beneficial during these stages of ISO 14001 certification (Please select as many or as few options as you wish):

- ☐ Before Certification
- ☐ During Certification
- ☐ After Certification
- ☐ We do not have experience or skills in this area

Page 2 - Question 27 - Choice - Multiple Answers (Bullets)

Experience and available skill sets in "Change Management" where beneficial during these stages of ISO 14001 certification (Please select as many or as few options as you wish):

- ☐ Before Certification
- ☐ During Certification
- ☐ After Certification
- ☐ We do not have experience or skills in this area

Page 2 - Question 28 - Open Ended - Comments Box

What key lessons/skills have you learnt through ISO 14001 implementation?


Page 2 - Question 29 - Rating Scale - Matrix

Relevant training and information has been provided to all employees in the form of:

	Yes	No	Don't know	N/A
Formal training days managed and run internally	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Formal training days run by a consultancy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Formal training provided by external parties	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Training as part of the induction procedure	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Via organisation wide emails	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Via notice boards	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Via internal newsletters	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Via external newsletters	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Informal talks	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
As part of pre-existing meeting plans	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>


Page 2 - Question 30 - Rating Scale - Matrix

Our organisation actively encourages open discussions and communication within and across different departments. If yes how?

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
Any further comment	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5
 Enter an answer					

Page 2 - Question 31 - Rating Scale - Matrix

When the EMS was implemented all employees were consulted

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
Any further comment	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5
 Enter an answer					

Page 2 - Question 32 - Rating Scale - Matrix

Communication is seen by the organisation as fundamental to the success of the EMS					
	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
Any further comment	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5
Enter an answer					

Page 2 - Question 33 - Rating Scale - Matrix

Our organisation partakes and actively encourages employees to participate in charitable, environmental and/or social activities.					
	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
Any further comment	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5
Enter an answer					

Page 2 - Question 34 - Rating Scale - Matrix

Our organisation chose to externally publicise the results of its environmental achievements			
	Yes	No	Don't know
Any further comment	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Enter an answer			

Page 2 - Question 35 - Rating Scale - Matrix

For each sector please state the level of commitment you believe was achieved in relation to your EMS					
	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
Top management	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5
Middle management	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5
Permanent staff	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5
Temporary staff	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5
Sub-contractors	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5

Page 2 - Question 36 - Ranking Question


Management review and auditing are important in terms of:						
Compliance to the requirements of ISO 14001	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Not receiving any nonconformities	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Improving the effectiveness of EMS	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reducing the environmental impact of our organisation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Communicating the effectiveness of the EMS to top management	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ensuring compliance to environmental legislation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Page 2 - Question 37 - Rating Scale - Matrix

Your organisation requires a number of:					
	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
Temporary staff	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5

Seasonal staff	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5
Sub-contractors	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5

Page 2 - Question 38 - Rating Scale - Matrix

Your organisation has a high turnover of permanent staff					
	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5
 Please explain					

Page 2 - Question 39 - Open Ended - Comments Box

What training has been provided to the Environmental Manager?

Page 2 - Question 40 - Open Ended - Comments Box

What percentage of your time is dedicated to the role of Environmental Manager?

Page 2 - Question 41 - Choice - One Answer (Bullets)

How many people are involved in your environmental team?
<input type="radio"/> 1 <input type="radio"/> 2 - 5 <input type="radio"/> 6 - 10 <input type="radio"/> 11 or above

Page 2 - Question 42 - Open Ended - Comments Box

What resources have been exploited to improve the effectiveness of the EMS?

Page 2 - Question 43 - Rating Scale - Matrix

Thank you very much for taking the time to complete this questionnaire. We welcome additional comments so please add those to the box below. If you would be happy to be contacted in the future, in relation to this research only, please select Yes, if so we may contact individuals to follow up on any issues arising from this survey.	
Yes	No
<input type="radio"/>	<input type="radio"/>

Page 2 - Question 44 - Open Ended - Comments Box

Feedback:

Thank You Page
Standard

Screen Out Page
Standard

Over Quota Page
Standard

Survey Closed Page
Standard

Appendix C Results of Statistical Analysis

C.1 Introduction

The data presented in this appendix is done so to provide an overview of the statistical analysis carried out for this research project. Key results referred to in the text are included as well as an overview of the complete set of statistical tests carried out for the development of the four factors. The results of question 20a are included in full as an example of the full set of analysis carried out for each question. The full test results can be viewed in the document entitled “Final Statistical Analysis” which is on the CD attached to this project.

C.2 Factor Analysis of Likert Type 5 Questions (18 in total)

Table C 1 Example of Factor Analysis carried out on Question Using the Likert-type 5 point scale

Question No.	Question	Factor 1	Factor 2	Factor 3	Factor 4
2	The goals of the organisation are clearly communicated to all employees. (Score 1-5)	0.267158	0.036458	0.172709	- 0.290935
5	Since the initial decision to implement ISO 14001 was made it has become more fundamental to the organisations business development? (Score 1-5)	0.253451	0.206627	0.600607	0.136446
6a	The implementation of the Environmental Management System (EMS) has been of significant value in terms of Financial return/savings	0.558048	0.172466	0.091934	0.085191
6b	The implementation of the Environmental Management System (EMS) has been of significant value in terms of Improved public perception	0.334244	0.077584	0.451446	0.286772
6c	The implementation of the Environmental Management System (EMS) has been of significant value in terms of Development of new business	0.150610	0.060434	0.730341	0.021962
6d	The implementation of the Environmental Management System (EMS) has been of significant value in terms of Retention of existing customers	0.109666	0.029303	0.837516	0.128710

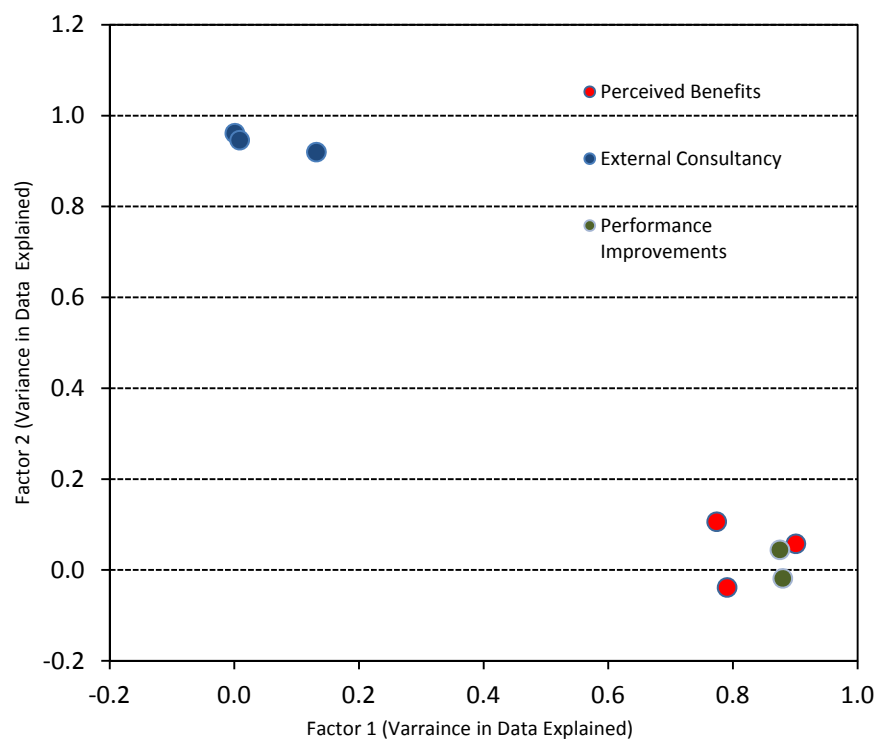


Figure C 1 : Factor 1 and 2 Groupings of Questions where the Principle Component was Greater than 0.7

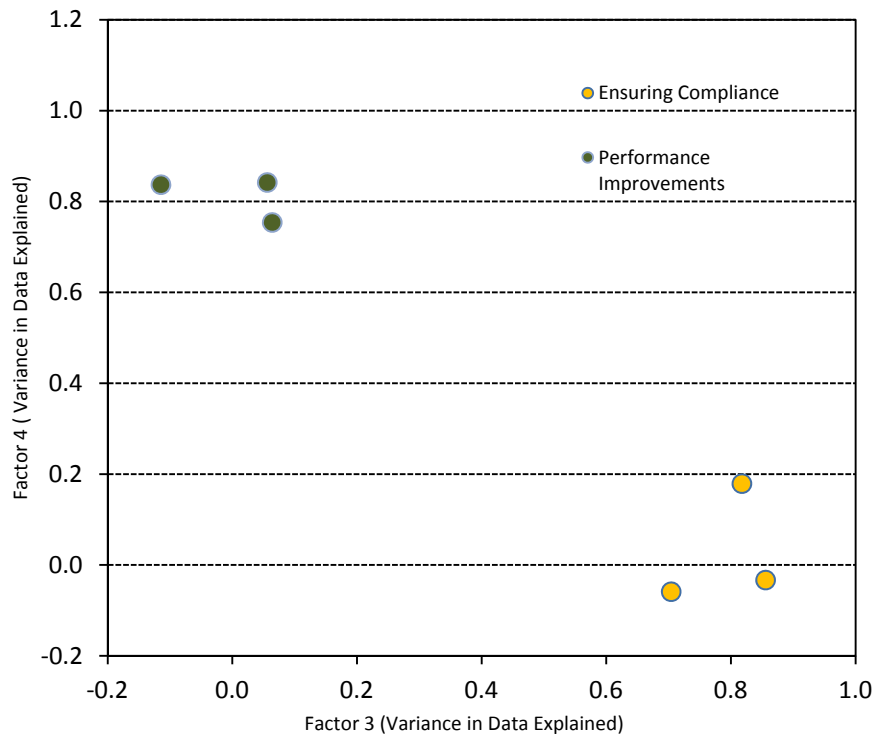


Figure C 2: Factor 3 and 4 Groupings of Questions where the Principle Component was Greater than 0.7

C.3 Scatter plot Graphs for the Remaining Questions (24 in Total)

Table C 2: Factor Analysis of Individual Cases

Case	Factor 1	Factor 2	Factor 3	Factor 4	Industry Size	Manufacturing (M) or Service (S) Sector Organisations	Certification (C) or Recertification (RC) Audit	Question 20a	Question 20b
1	1.06748	0.44372	0.52204	0.58800	SME	S	C	1	1
2	-1.28637	-1.88562	-0.81964	-0.40062	SME	S	RC	2	1
3	-0.08403	1.24699	-0.97137	-0.23765	SME	M	C	1	1
4	0.81354	-0.29356	0.77846	-1.01799	SME	M	RC	2	1
5	0.03755	-1.29805	-0.76624	-0.04149	SME	M	C	1	1
6	-0.47531	-2.02535	2.25610	1.92130	NONSME	M	C	2	1

C.3.1 Organisation Size (SME or Non SME)

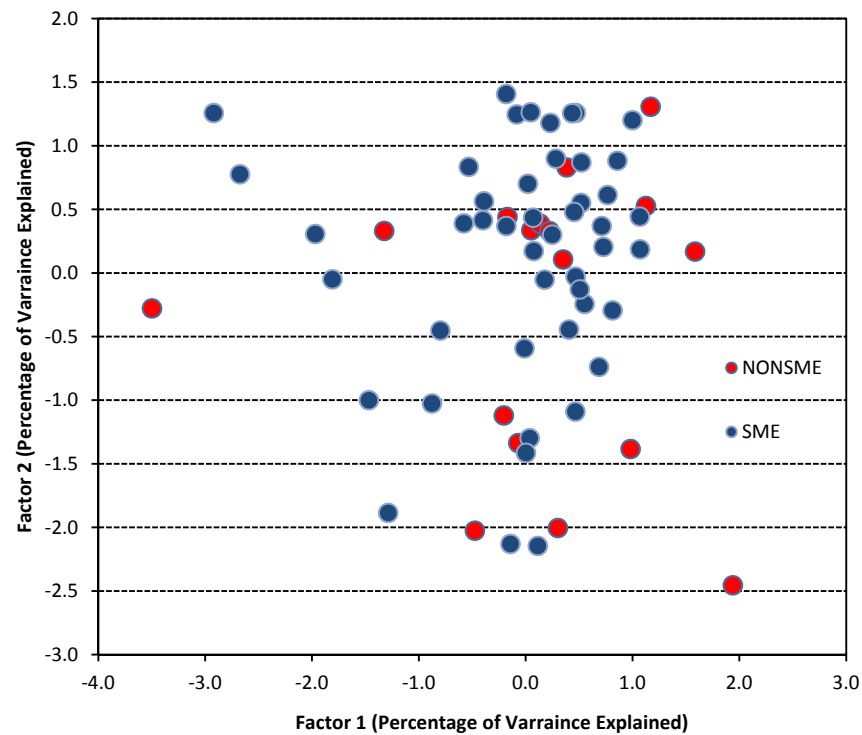


Figure C 3: Scatter Plot of Factors 1 and 2 Labelled by Organisational Size

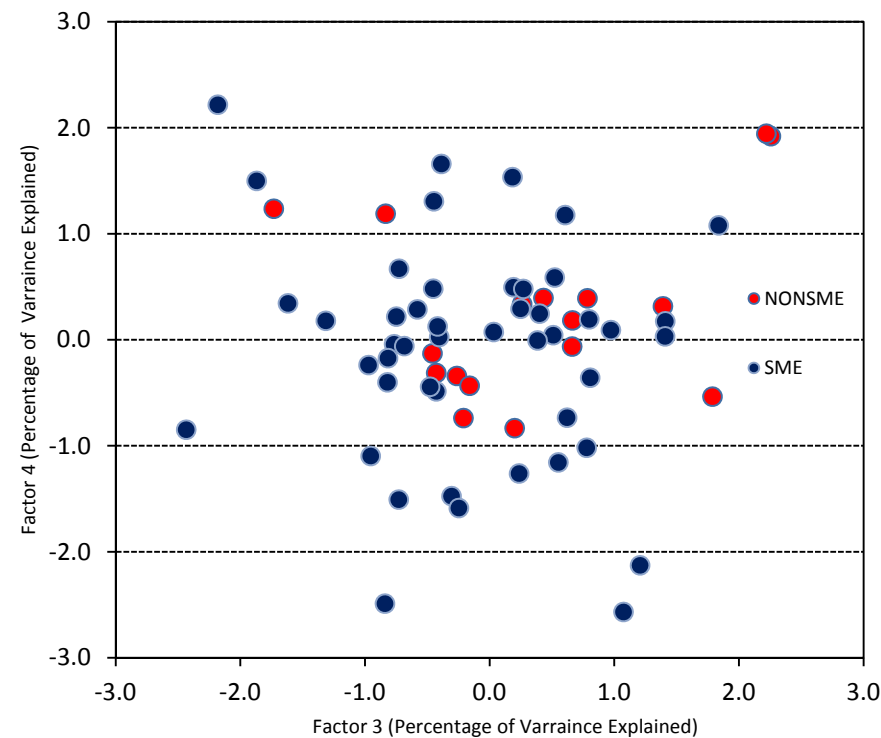


Figure C 4: Scatter Plot of Factors 3 and 4 Labelled by Organisational Size

Table C 3: P Values Results for potential relationship between the Factors and the method of organisational categorisation (Size)

Factor 1	SS	Degr. of	MS	F	p
Intercept	0.15893	1	0.158929	0.154619	0.695577
Industry Size	0.58924	1	0.589240	0.573259	0.451980
Error	60.64478	59	1.027878		

Factor 2	SS	Degr. of	MS	F	p
Intercept	0.28973	1	0.289735	0.296040	0.588426
Industry Size	2.22668	1	2.226684	2.275144	0.136800
Error	57.74333	59	0.978701		

Factor 3	SS	Degr. of	MS	F	p
Intercept	0.56632	1	0.566317	0.579701	0.449462
Industry Size	3.02360	1	3.023602	3.095062	0.083715
Error	57.63779	59	0.976912		

Factor 4	SS	Degr. of	MS	F	p
Intercept	0.25160	1	0.251602	0.254211	0.616003
Industry Size	1.64450	1	1.644497	1.661553	0.202425
Error	58.39434	59	0.989735		

C.3.2 Organisation Type (Manufacturing or Service sector)

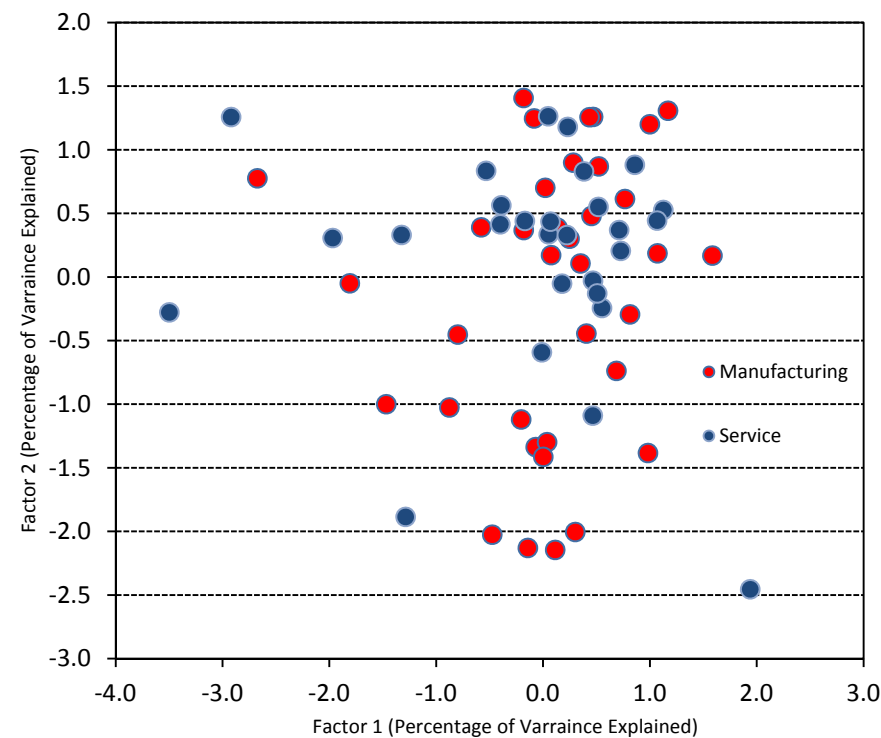


Figure C 5: Scatter Plot of Factors 1 and 2 Labelled by Organisational Type

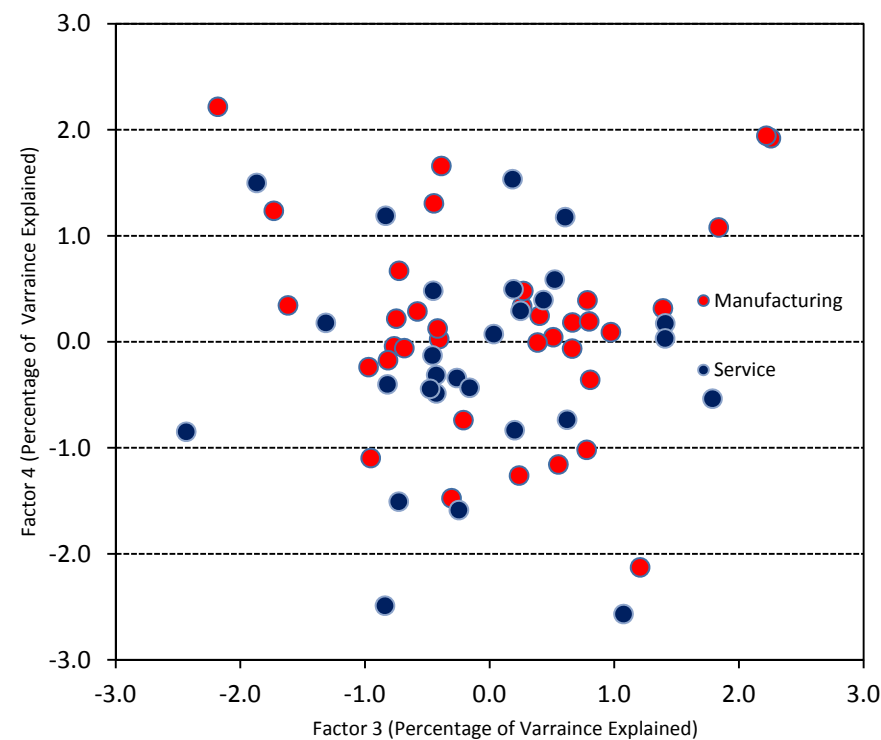


Figure C 6: Scatter Plot of Factors 3 and 4 Labelled by Organisational Type

Table C 4: P Values Results for potential relationship between the Factors and the method of organisational categorisation (Type)

Factor 1	SS	Degr. of	MS	F	p
Intercept	0.15893	1	0.15892 9	0.15461 9	0.69557 7
Manufacturing (M) or Service Sector Organisations	1.29165	1	1.29165 1	1.25662 0	0.26683 4
Error	60.6447 8	59	1.02787 8		

Factor 2	SS	Degr. of	MS	F	p
Intercept	0.28973	1	0.28973 5	0.29604 0	0.58842 6
Manufacturing (M) or Service Sector Organisations	1.88641	1	1.88641 4	1.92746 8	0.17025 6
Error	57.7433 3	59	0.97870 1		

Factor 3	SS	Degr. of	MS	F	p
Intercept	0.56632	1	0.56631 7	0.57970 1	0.44946 2
Manufacturing (M) or Service Sector Organisations	1.45276	1	1.45276 1	1.48709 5	0.22752 0
Error	57.6377 9	59	0.97691 2		

Factor 4	SS	Degr. of	MS	F	p
Intercept	0.25160	1	0.25160 2	0.25421 1	0.61600 3
Manufacturing (M) or Service Sector Organisations	2.92723	1	2.92723 1	2.95759 2	0.09071 7
Error	58.3943 4	59	0.98973 5		

C.3.3 Audit Type (Certification or Recertification)

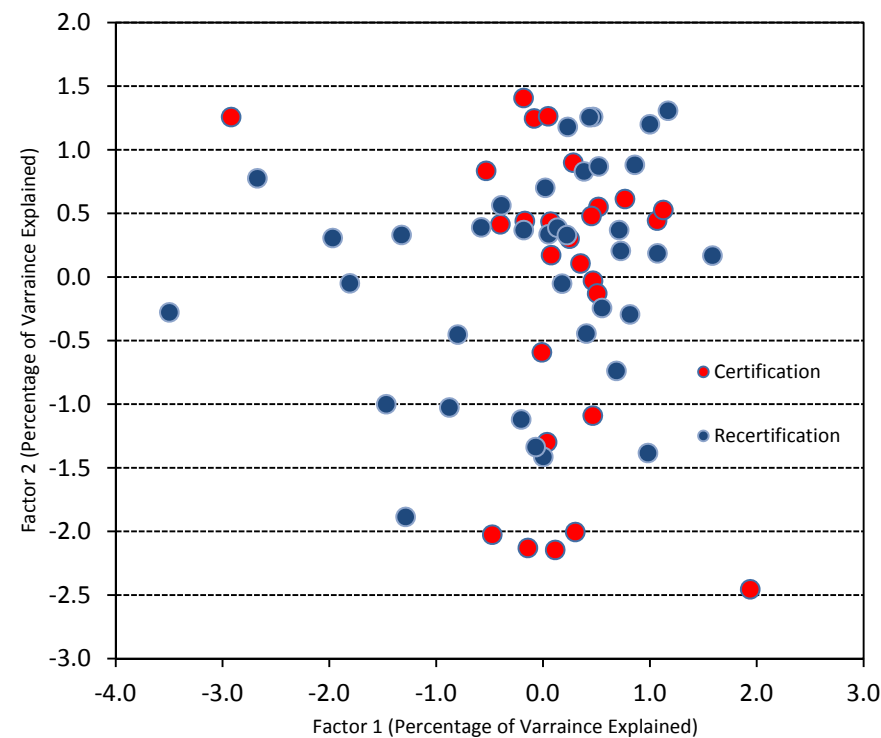


Figure C 7: Scatter Plot of Factors 1 and 2 Labelled by Stage of Certification

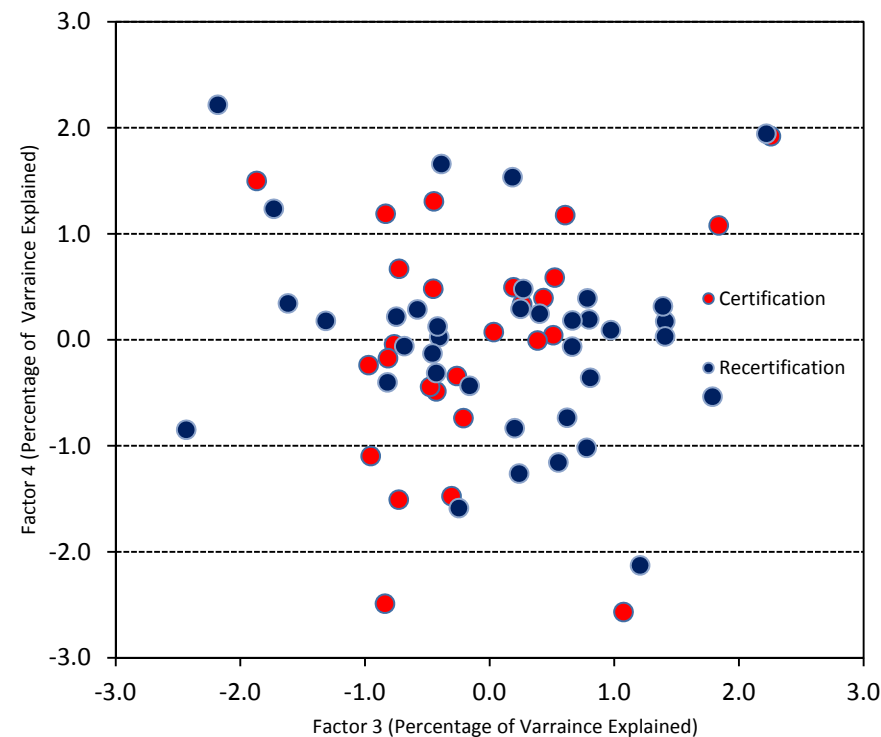


Figure C 8: Scatter Plot of Factors 3 and 4 Labelled by Stage of Classification

Table C 5: P Values Results for potential relationship between the Factors and the method of organisational categorisation (Stage of Certification)

Factor 1	SS	Degr. of	MS	F	p
Intercept	0.02716	1	0.027155	0.026714	0.870709
Certification (C) or Recertification (RC) Audit	0.95013	1	0.950131	0.934697	0.337463
Error	62.00726	61	1.016512		

Factor 2	SS	Degr. of	MS	F	p
Intercept	0.00098	1	0.000981	0.000979	0.975141
Certification (C) or Recertification (RC) Audit	0.57448	1	0.574478	0.573048	0.451964
Error	61.15220	61	1.002495		

Factor 3	SS	Degr. of	MS	F	p
Intercept	0.02740	1	0.027398	0.039795	0.844001
Certification (C) or Recertification (RC) Audit	4.48615	7	0.640879	0.930878	0.505661
Error	13.08088	19	0.688467		

Factor 4	SS	Degr. of	MS	F	p
Intercept	0.00301	1	0.003014	0.002926	0.957041
Certification (C) or Recertification (RC) Audit	0.00176	1	0.001760	0.001708	0.967166
Error	62.84198	61	1.030196		

C.3.4 Question 20a: Do you feel the performance of your EMS has improved other aspects of performance in relation to Business development (1-yes / 2-No / 3-Don't Know):

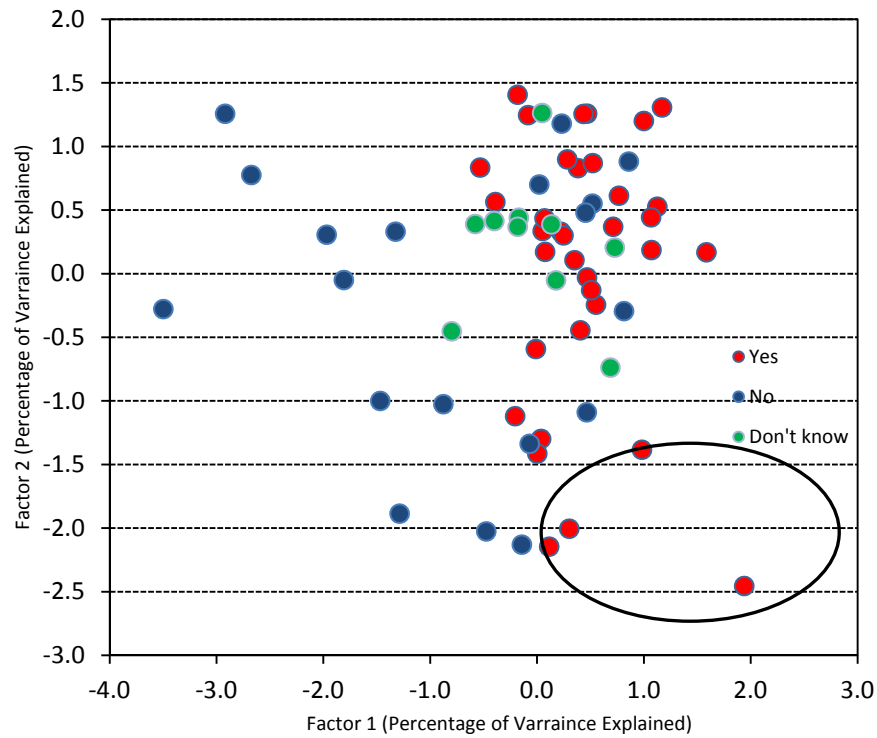


Figure C 9: Scatter Plot of Factors 1 and 2 Labelled by Question 20a

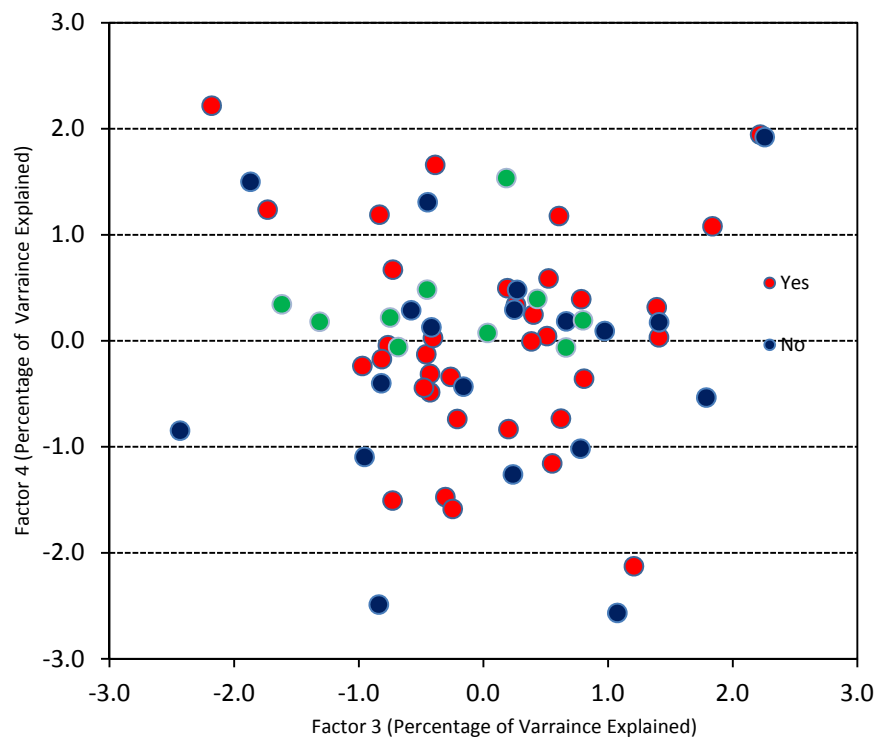


Figure C 10: Scatter Plot of Factors 3 and 4 Labelled by Question 20a

Table C 6: P Values Results for potential relationship between the Factors and the method of organisational categorisation (Question 20a)

Factor 1	SS	Degr. of	MS	F	p
Intercept	0.75538	1	0.755376	1.03938	0.312058
Question 20a	19.35217	2	9.676084	13.31412	0.000016
Error	43.60522	60	0.726754		

Factor 2	SS	Degr. of	MS	F	p
Intercept	0.03749	1	0.037488	0.037647	0.846809
Question 20a	1.98024	2	0.990118	0.994320	0.375988
Error	59.74644	60	0.995774		

Factor 3	SS	Degr. of	MS	F	p
Intercept	0.19217	1	0.192169	0.187293	0.666731
Question 20a	0.81340	2	0.406701	0.396383	0.674498
Error	61.56188	60	1.026031		

Factor 4	SS	Degr. of	MS	F	p
Intercept	0.08192	1	0.081918	0.080863	0.777110
Question 20a	2.06159	2	1.030793	1.017529	0.367639
Error	60.78215	60	1.013036		

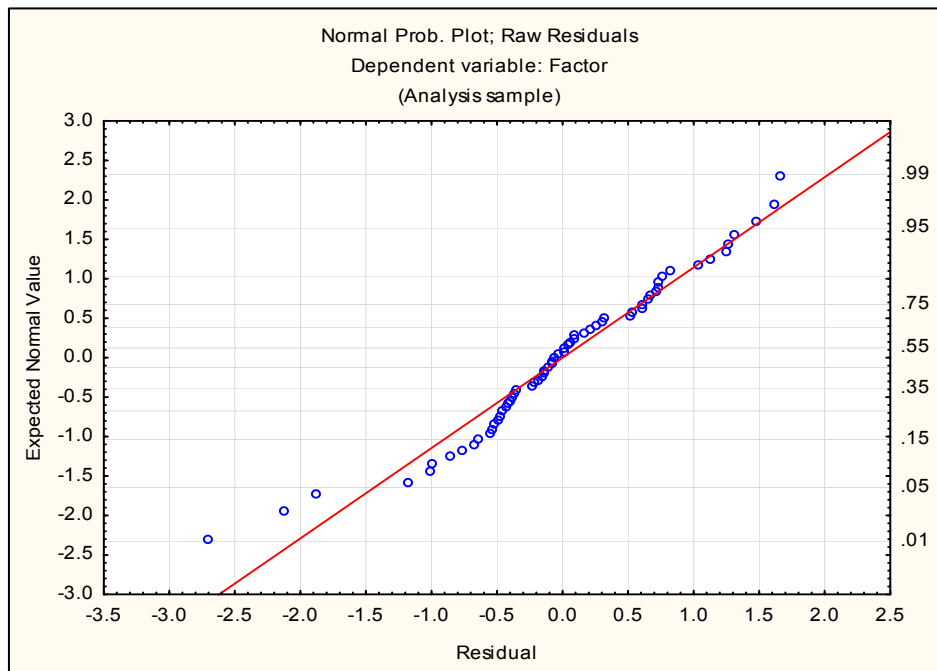


Figure C 11: Probability Plot of Data for Question 20a

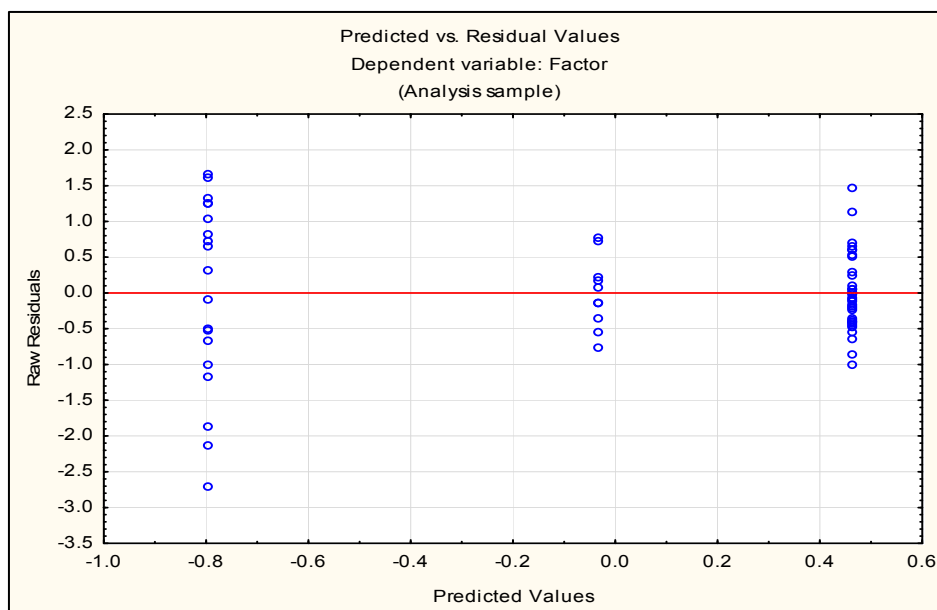


Figure C 12: Predicted vs Residual Values for Question

Table C 7: Factor Grouping for Question 20a

	Question 20a	Factor	1	2
2	2	- 0.797397		****
3	3	- 0.035496	****	
1	1	0.462068	****	

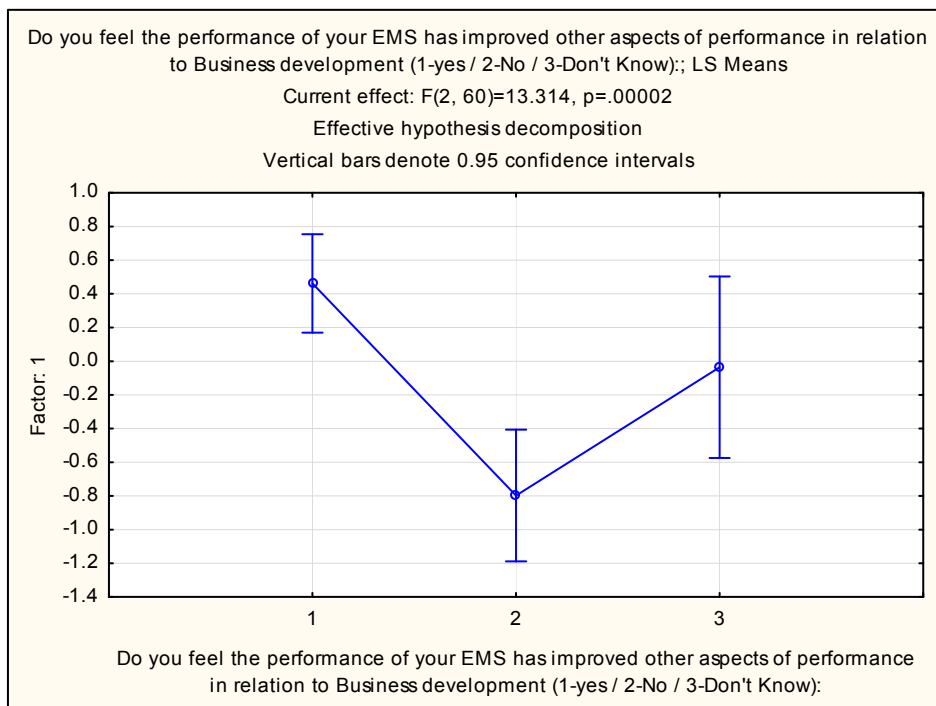


Figure C 13: Effective Hypothesis Decomposition Representing Scoring of Question 20a

C.3.5 Question 20e: Do you feel the performance of your EMS has improved other aspects of performance in relation to waste (1-yes / 2-No / 3-Don't Know):

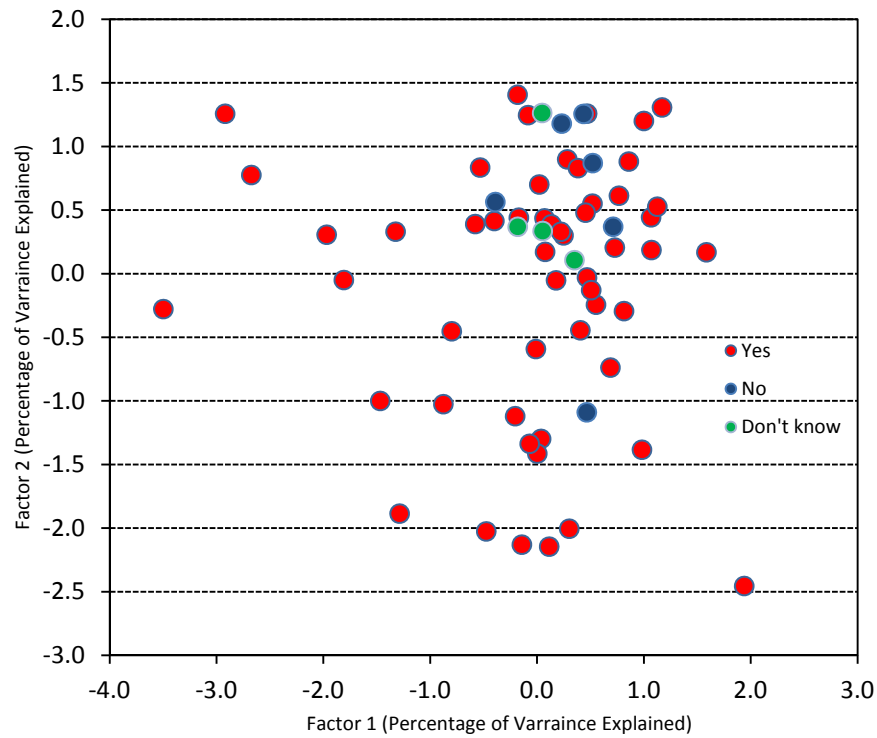


Figure C 14: Scatter Plot of Factors 1 and 2 Labelled by Question 20e

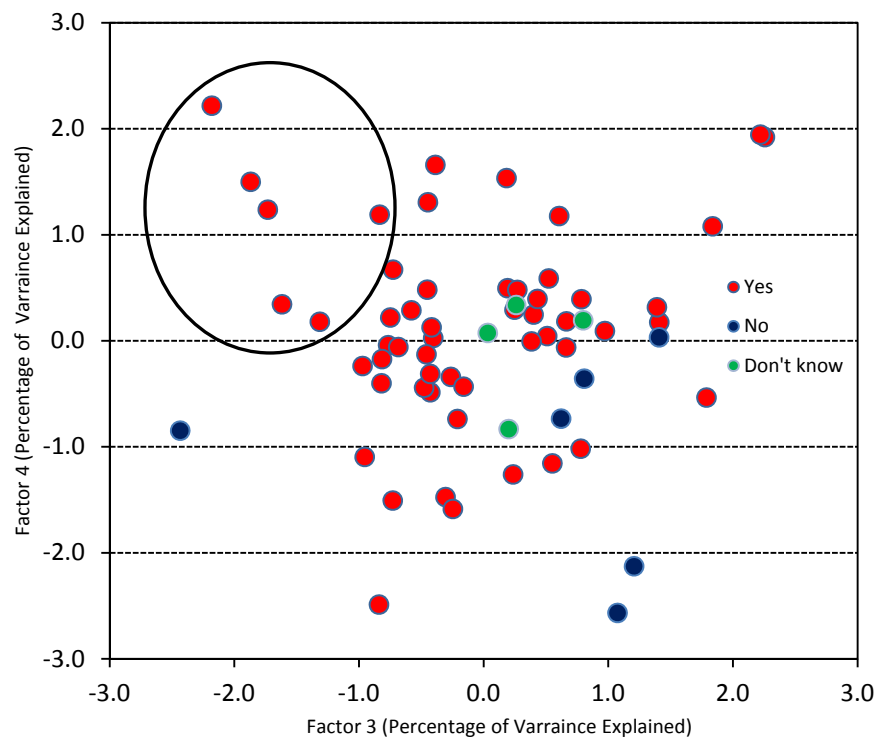


Figure C 15: Scatter Plot of Factors 3 and 4 Labelled by Question 20e

Table C 8: P Values Results for potential relationship between the Factors and the method of organisational categorisation (Question 20e)

Factor 1	SS	Degr. of	MS	F	p
Intercept	0.13380	1	0.133796	0.127105	0.722724
Question 20e	0.72961	2	0.364807	0.346565	0.708543
Error	62.10547	59	1.052635		

Factor 2	SS	Degr. of	MS	F	p
Intercept	2.34934	1	2.349335	2.370646	0.128982
Question 20e	3.24899	2	1.624496	1.639232	0.202846
Error	58.46962	59	0.991010		

Factor 3	SS	Degr. of	MS	F	p
Intercept	0.94786	1	0.947864	0.926880	0.339604
Question 20e	1.96387	2	0.981933	0.960195	0.388719
Error	60.33570	59	1.022639		

Factor 4	SS	Degr. of	MS	F	p
Intercept	2.62598	1	2.625984	2.838517	0.097312
Question 20e	8.14110	2	4.070550	4.399998	0.016552
Error	54.58240	59	0.925125		

Appendix D Graphical Representation of Questionnaire Results

D.1 Introduction

This appendix provides a graphical representation of the results from the questionnaire sent to the clients of SGS certified to ISO 14001. Qualitative data collected has not been amended in any way so may still contain errors.

D.2 Question 2: The goals of the organisation are clearly communicated to all employees.

D.2.1 Quantitative Data

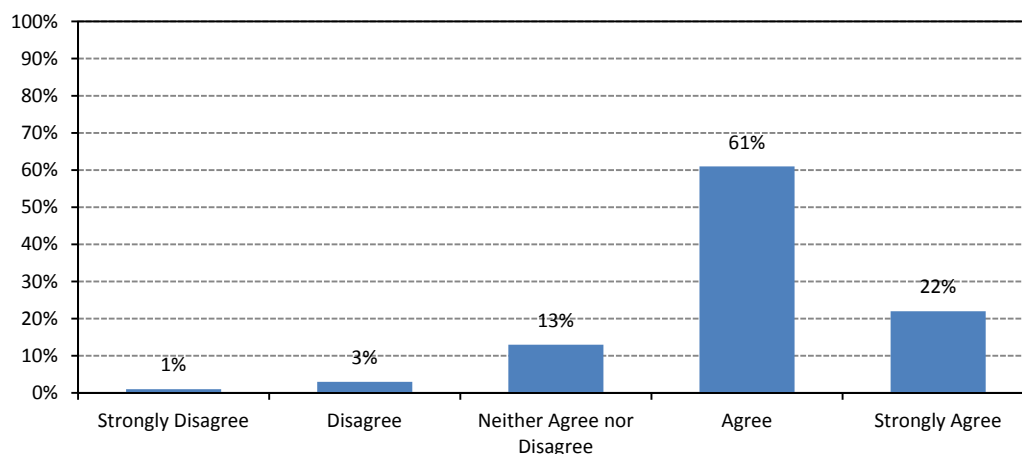


Figure D 2 Question 2: The goals of the organisation are clearly communicated to all employees.

D.2.2 Qualitative Data

- 2.1 Could be pushed forward more
- 2.2 There is no mission statement for the UK region but the US region does have one
- 2.3 This is only because the internal sustainability team is so proactive. The communication comes from them, not the Senior Management.
- 2.4 Difficult as 80% are field based
- 2.5 We publish our CR goals to the public and these are also made available to our staff.
- 2.6 All available on organisation intranet site. Cannot guarantee that everyone reads it

- 2.7 Communicated through Environmental Policy, Environmental Manual, and monthly Employee Briefs
- 2.8 Regular organisation updates via monthly enclosures and newsletter
- 2.9 Via Employee Road shows; Our Vision, Our Values, Our Way; and our medium term goals in the categories of customer; competitiveness; people, environment; and communities.

D.3 Question 3: To what extent did each of the following drivers influence your decision to implement ISO 14001?

D.3.1 Quantitative Data

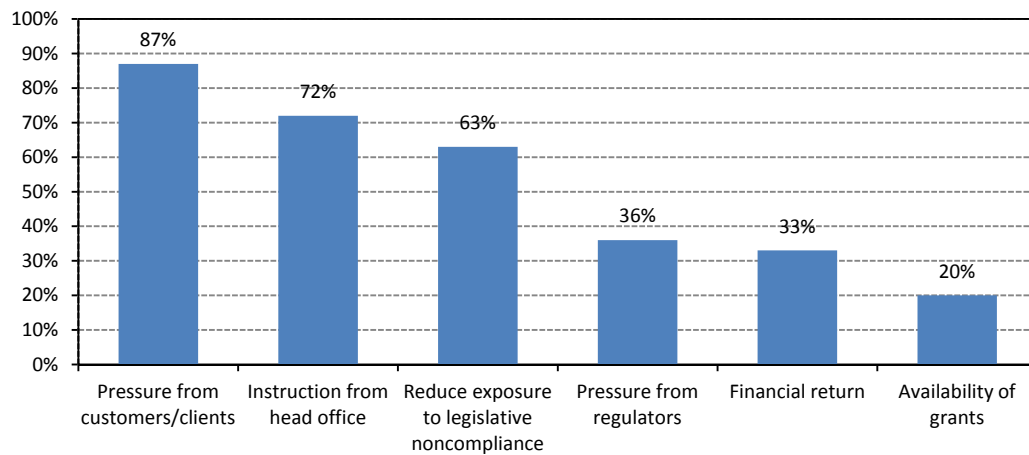


Figure D 3: Question 3: The percentage of people responding "Agree" to the question: To what extent did each of the following drivers influence your decision to implement ISO 14001?

D.4 Question 4: The percentage of people responding “Agree” to the question: To what extent do the following aspects motivate you to maintain your certification to ISO 14001?

D.4.1 Quantitative Data

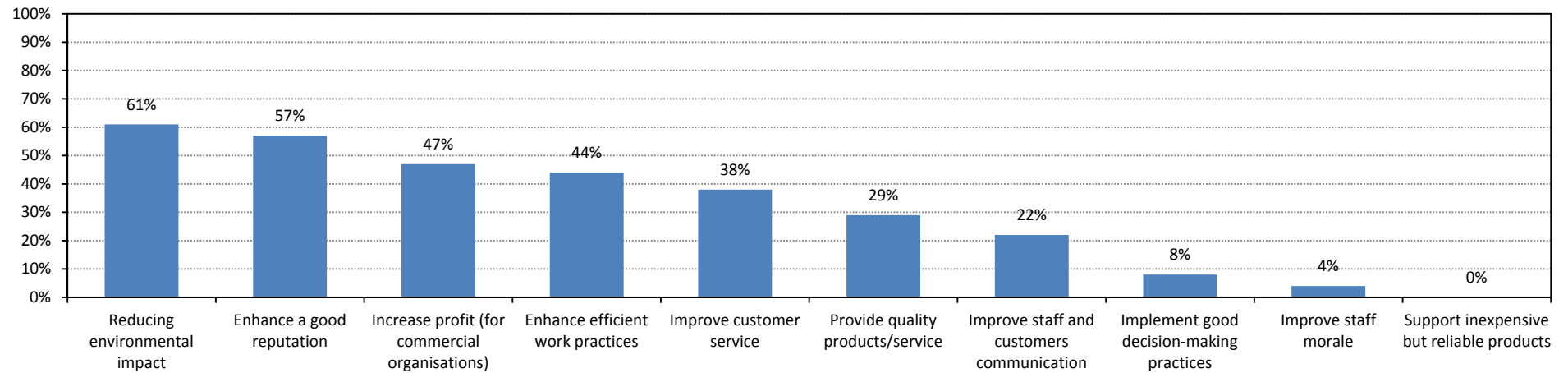


Figure D 4: Question 4: The percentage of people responding “Agree” to the question: To what extent do the following aspects motivate you to maintain your certification to ISO 14001?

D.5 Question 5: Since the initial decision to implement ISO 14001 was made it has become more fundamental to the organisations business development?

D.5.1 Quantitative Data

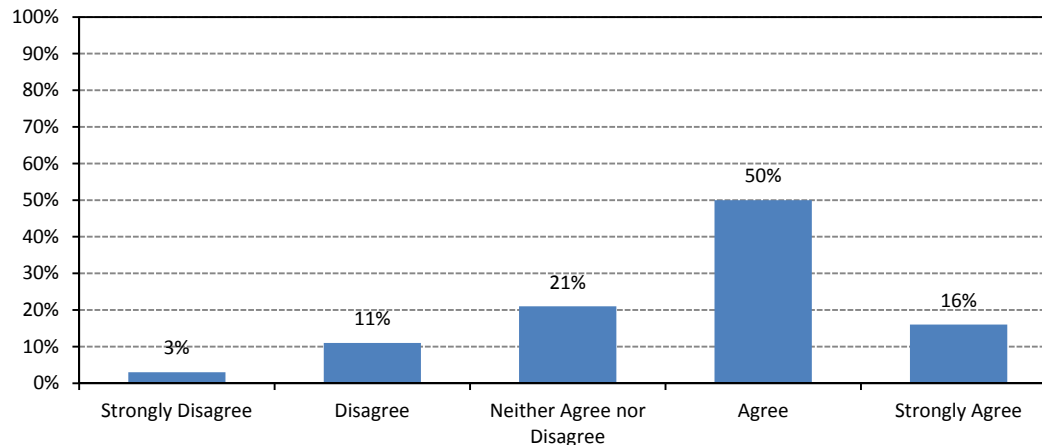


Figure D 5: Question 5: Since the initial decision to implement ISO 14001 was made it has become more fundamental to the organisations business development?

D.5.2 Quantitative Data

- 5.1 It has helped us improve performance, customer care and ensures the staff are clear about our key objectives and social impacts.
- 5.2 ISO14001 considerations do not form part of the strategic business decisions
- 5.3 The Senior Management only want 14001 retained to meet customer requirements. Its more fundamental because more customers want it.
- 5.4 Due to the promotion of Sustainable Development agenda by Welsh Government
- 5.5 It is now more important than ever set environmental improvement objectives, to identify areas where money can be saved and to ensure legal compliance is met. ISO 14001 provides this framework
- 5.6 The environmental impact of any work undertaken by the organisation is now always considered prior to commencement.
- 5.7 We need the accreditation to bid for new work with new clients.

D.6 Question 6: The percentage of people responding “Agree” to the question: The implementation of the Environmental Management System (EMS) has been of significant value in terms of:

D.6.1 Quantitative Data

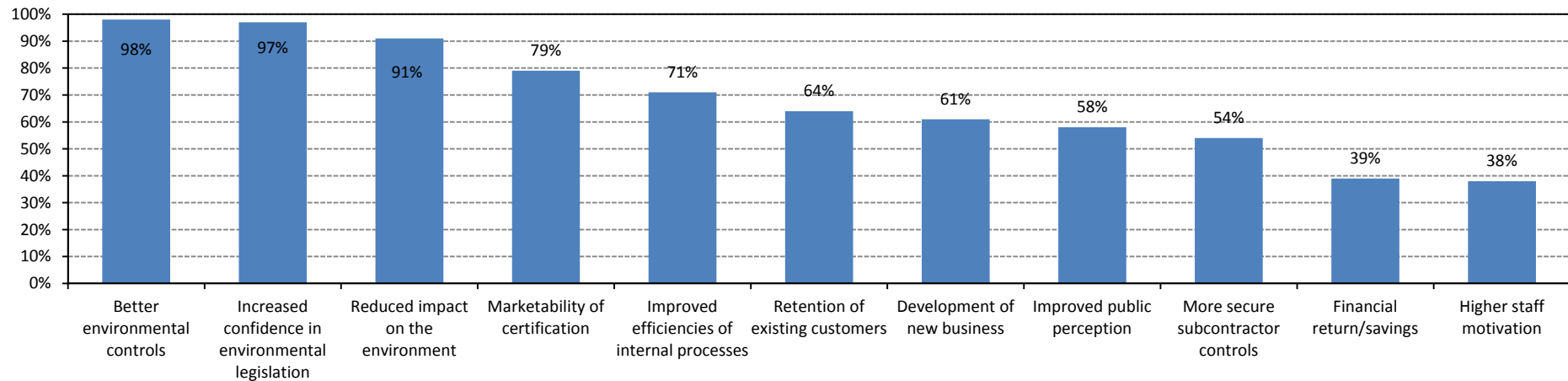


Figure D 6: Question 6: The percentage of people responding “Agree” to the question: The implementation of the Environmental Management System (EMS) has been of significant value in terms of:

D.7 Question 7: The percentage of people responding “Agree” to: the question: Which aspects of your EMS do you believe are most likely to cause nonconformities

D.7.1 Quantitative Data

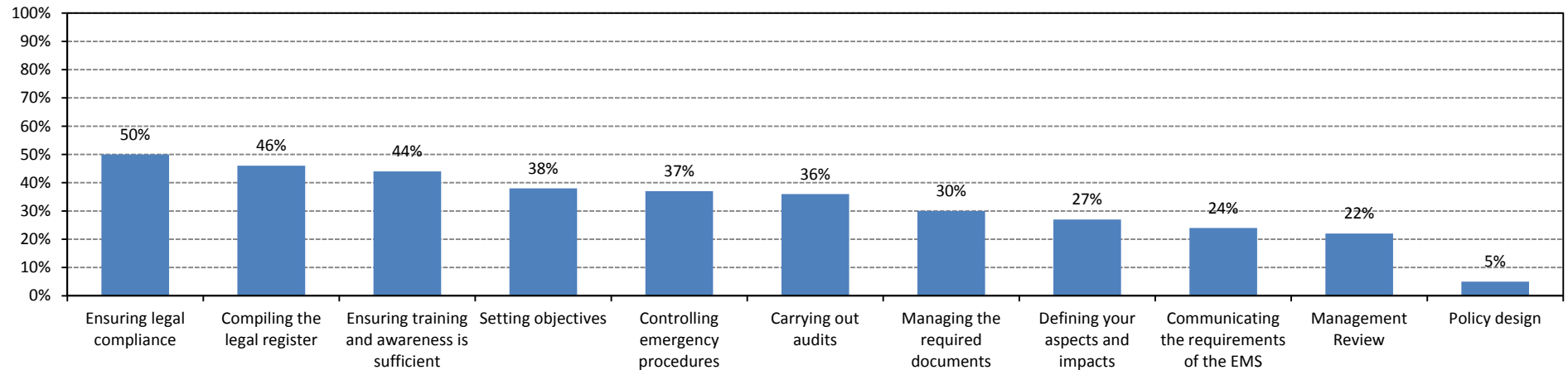


Figure D 7: Question 7: The percentage of people responding “Agree” to: the question: Which aspects of your EMS do you believe are most likely to cause nonconformities?

D.8 Question 8: Does your organisation maintain certification to other standards? If so which ones?

D.8.1 Qualitative Data

Table D 1: Question 8: Does your organisation maintain certification to other standards? If so which ones?

Organisations that have ISO 14001 and at least one other Standard	74 out of 88	84.09%
Organisations that have ISO 14001 and at least two other Standards	37 out of 88	42.05%
Organisations that have ISO 14001 and ISO 9001	63 out of 88	71.6%
Organisations that have ISO 14001 and BS EN 18001	14 out of 88	16%
Organisations that have ISO 14001 and other ISO standard (Not ISO 9001 or BS OHSAS 18001)	16 out of 88	18.18%
Organisations that have ISO 14001 and another non ISO standard	20 out of 88	22.7%

D.9 Question 9: Our organisation integrates its policy and procedures for multiple standards

D.9.1 Quantitative Data

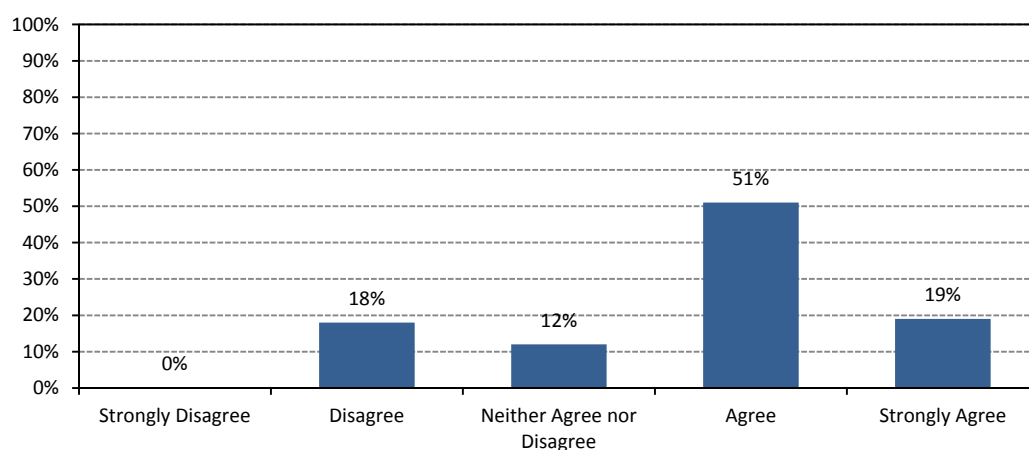


Figure D 9: Question 9: Our organisation integrates its policy and procedures for multiple standards

D.9.2 Qualitative Data

- 9.1 We have developed an Integrated Management System which integrates 9001 and 14001.
- 9.2 We have integrated procedures where they are generic to the standards.
- 9.3 The policy is not integrated but the procedures are
- 9.4 Have just completed a single system audit for 14001, 9001, 18001 and 27001 and passed. Is saving business £1000's in terms of auditor costs and time spent on managing systems. This was driven by a forward thinking Compliance Director, not by Senior Management
- 9.5 We try but our QA system is part of a european groupm system with another assessment body
- 9.6 We use the same CR policy across the organisation, even though our ISO14001 certification only covers our developments over a £5m cost threshold.
- 9.7 It is a business objective to fully integrate the existing 4 x ISO's currently held by 2013.
- 9.8 We used too and have a joint audit. We haven't changed the procedures since giving back the certificate.
- 9.9 The scope for each standard is not the same which makes integration impossible at present.
- 9.10 Parent organisation has procedures we need to follow
- 9.11 Part integration
- 9.12 Integrate wherever possible i.e Producers for Training, Control of Documents/Records, Internal Audits etc are applicable to Quality, Environmental & H&S Standards
- 9.13 We only integrate the 18001 & 14001 (the 9001 is stand alone)
- 9.14 We use an integrated management system approach
- 9.15 Currently operate integrated sytem to 9001, 14001 and 18001.
- 9.16 Of necessity these are run by different teams in the organisation.

D.10 Question 10: Sufficient resources where allocated to the implementation of ISO 14001

D.10.1 Quantitative Data

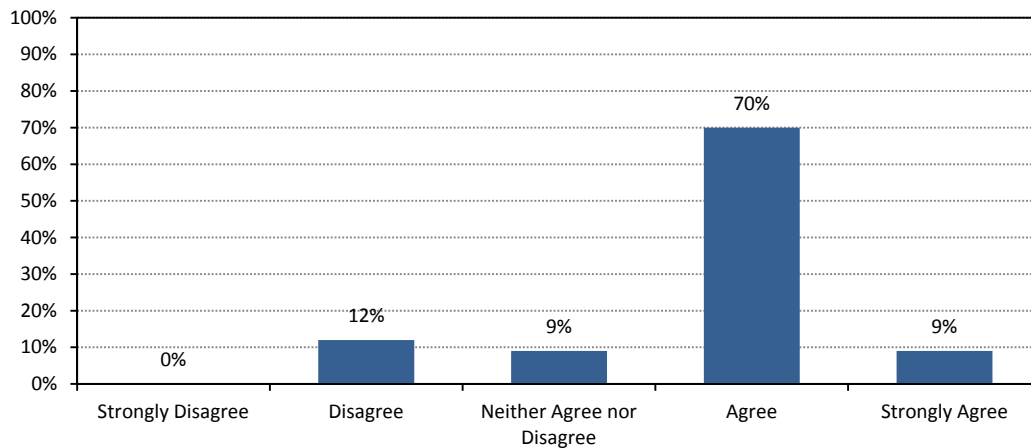


Figure D 10: Question 10: Sufficient resources where allocated to the implementation of ISO 14001

D.10.2 Qualitative Data

- 10.1 Economic conditions do mean resources allocated have been shrunk but we are aware of the need to maintain standards to remain competitive.
- 10.2 The resources are only allocated for auditing for the salaries of a full-time environmental advisor and HSQE manager. There are no resources allocated to achieving objectives and targets i.e. improvements
- 10.3 As Management Representative, sometimes feel others think it is my role and not theirs
- 10.4 Lead Green Champions and Green Champions were recruited from within the business across all departments and locations.
- 10.5 some parts of the organisation had difficulties finding sufficient resources
- 10.6 i dedicated staff member and 2 outside consultants
- 10.7 We were assisted by a consultancy organisation & our existing 9001 auditing organisation (SGS).

D.11 Question 11: Our organisation maintains ISO 14001 as part of a wider Corporate Social Responsibility strategy

D.11.1 Quantitative Data

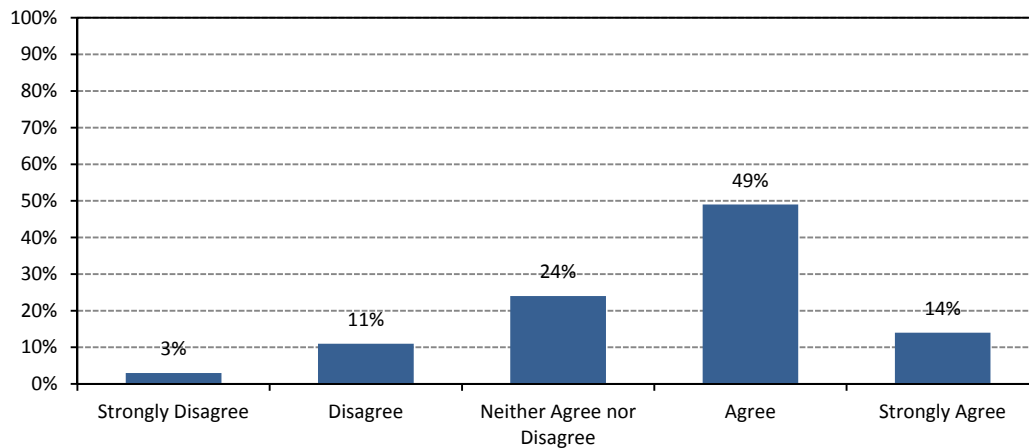


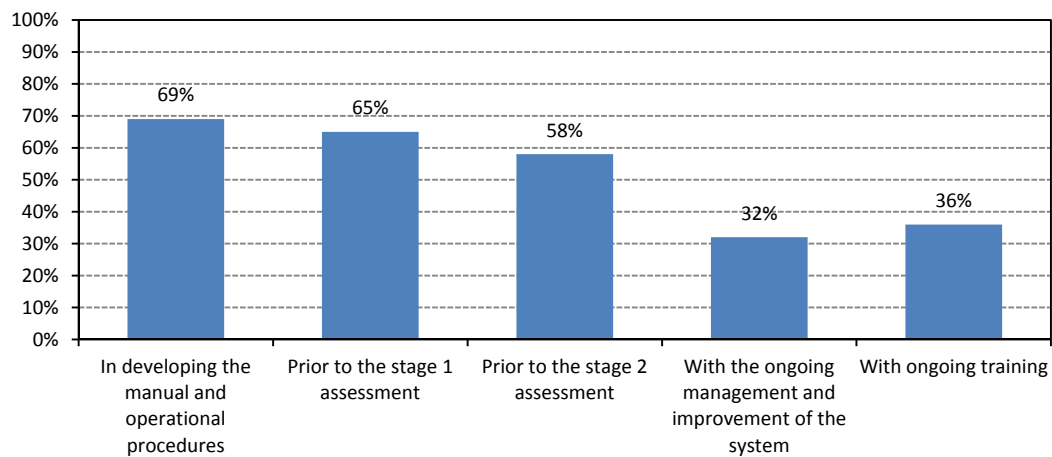
Figure D 11: Question 11: Our organisation maintains ISO 14001 as part of a wider Corporate Social Responsibility strategy

D.11.2 Qualitative Data

- 11.1 We are a charity and therefore had strong social and environmental objectives in place before implementing 14001
- 11.2 Although we have been trying to bring out our inaugural CSR report for a year now due to fear of the implications on business bottom line it has yet to be approved by the CEO. The ISO14001 monitoring data will then supposedly feed into the CSR KPI's.
- 11.3 ORGANISATION signed the UN CSR charter
- 11.4 Not convinced fully integrated in to business planning

**D.12 Question 12: The percentage of people responding “Agree” to:
the question: External consultancy was most beneficial
when?**

D.12.1 Quantitative Data



**Figure D 12: Question 12: The percentage of people responding “Agree” to: the
question: External consultancy was most beneficial when**

D.13 Question 13: The organisation communicates the outcomes of the EMS internally via (Please select those that apply)

D.13.1 Quantitative Data

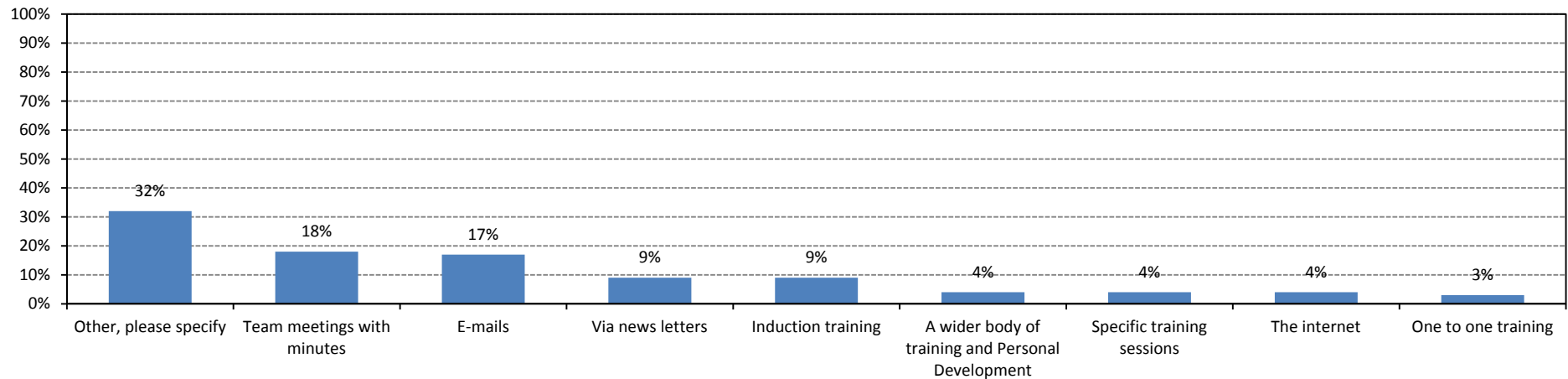


Figure D 13: Question 13: The organisation communicates the outcomes of the EMS internally via (Please select those that apply)

D.13.2 Qualitative Data

- 13.1 couldn't select more than one; however points 1, 3, 5 & 6 apply to your question.
- 13.2 Intranet
- 13.3 Email, team meetings, specific training, induction news letters
- 13.4 q13 ONLY ALLOWS SELECTION OF ONE OPTION WHEN SEVERAL APPLY.
- 13.5 EMail, Intranet, Team Meetings, Induction Training
- 13.6 all of the above
- 13.7 All the above (no multi-select)
- 13.8 Internal intranet
- 13.9 Emails, Intranet (internal), training, mailers, documents
- 13.10 Emails, Meetings, induction
- 13.11 All of the above
- 13.12 internal intranet
- 13.13 Notice Boards
- 13.14 Can only select 1 we do most of these other than one to one training as we do it in groups
- 13.15 all of the above
- 13.16 All of the above
- 13.17 Will not let me select multiples - Email, Team Meetings, Specific Training, Induction Training
- 13.18 Question cannot select more than one, so listed here: Emails, Internet, Team meetings with minutes, Induction training, As part of documented wider body of training and ongoing personal development, Via newsletters.
- 13.19 Via our 6 Monthly Management Review Meetings with all staff.
- 13.20 Bi-monthly Management Team Talk briefings to all employees
- 13.21 This question has been set to only take one answer, but I would answer yes to all of these
- 13.22 wanted to select e-mails, internet, specific training sessions, induction training, news letters but couldn't
- 13.23 Was only allowed to select one, we actually use our intranet, induction training and news letters
- 13.24 Multiple selection does not work - methods are emails, team meetings, specific

training sessions, induction training

13.25 Notice board

D.14 Question 14: Our EMS is integrated with existing processes and procedures e.g. setting of objective and/or purchasing.

D.14.1 Quantitative Data

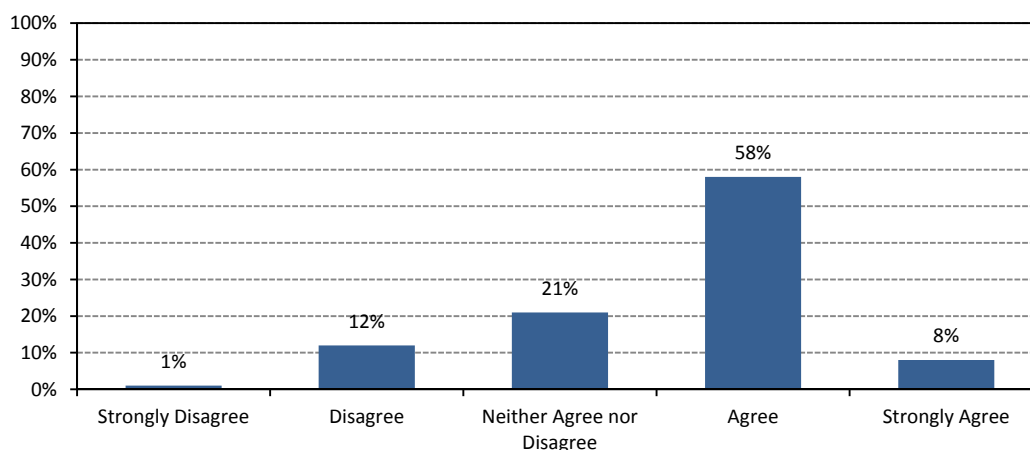


Figure D 14: Question 14: Our EMS is integrated with existing processes and procedures e.g. setting of objective and/or purchasing

D.14.2 Qualitative Data

- 14.1 We have implemented a green procurement procedure
- 14.2 The only aspect of our EMS that is integrated into our processes and procedures is that which is required to ensure legal compliance.
- 14.3 Agree to some degree. Integrated with internal processes but business structure and lack of ambition from Senior Management are restricting improvements to supplier environmental management
- 14.4 Refreshed objectives have been drafted with H&S in mind but not yet approved by Board
- 14.5 To some extent.
- 14.6 Integration is a weakness, but we are improving in this area.
- 14.7 We would not be able to retain our accreditation if we did not integrate with purchasing, but Objective Setting is kept separate.

D.15 Question 15: If your organisation undertakes any of the following, how often?

D.15.1 Quantitative Data

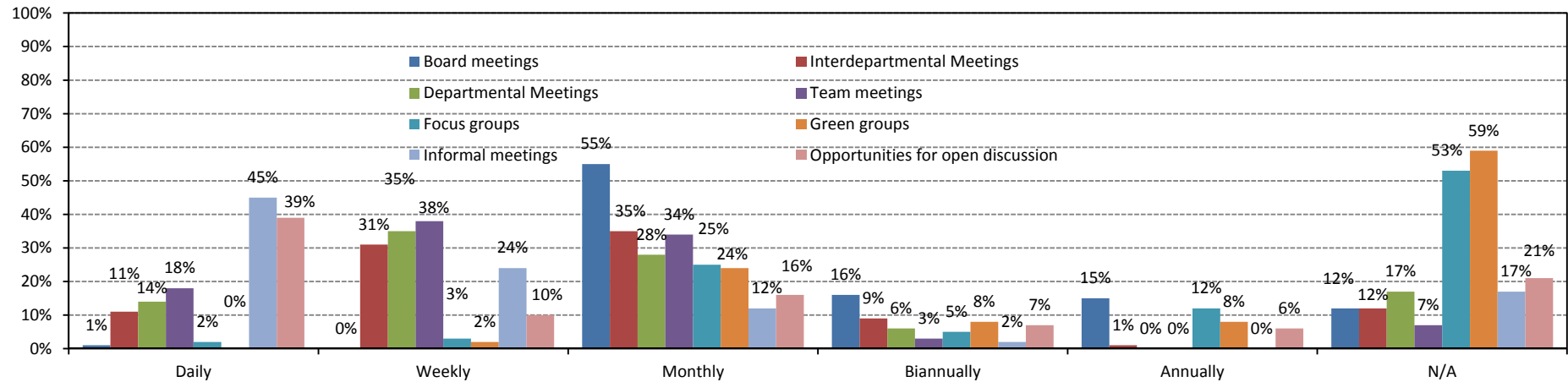


Figure D 15: Question 15: If your organisation undertakes any of the following, how often?

D.16 Question 16: Employees can access information relevant to ISO 14001 via:

D.16.1 Quantitative Data

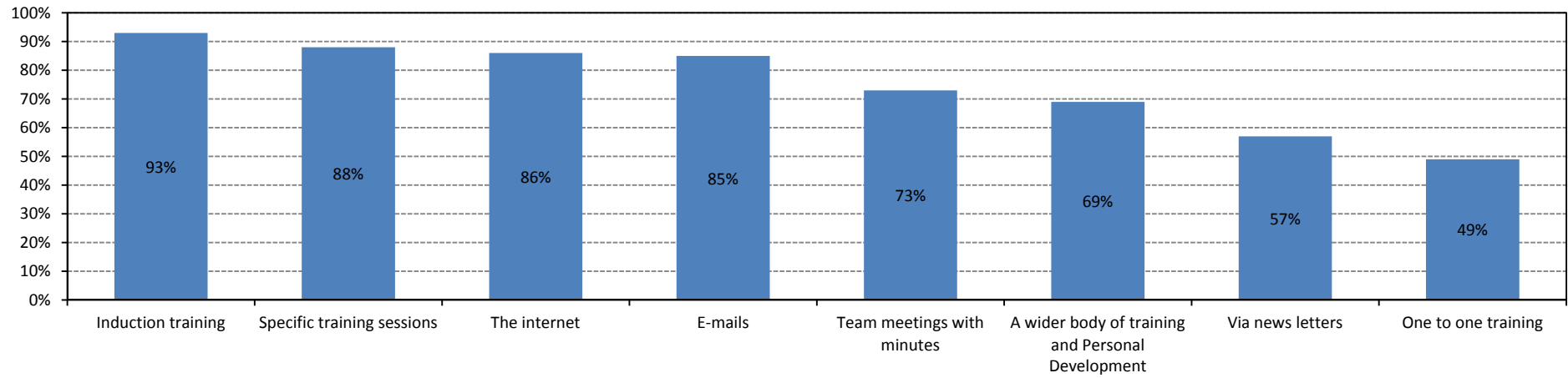


Figure D 16: Question 16: Employees can access information relevant to ISO 14001 via:

D.17 Question 17: The percentage of people responding “Agree” to the question: The aspects of your EMS you believe actually caused the most problems

D.17.1 Quantitative Data

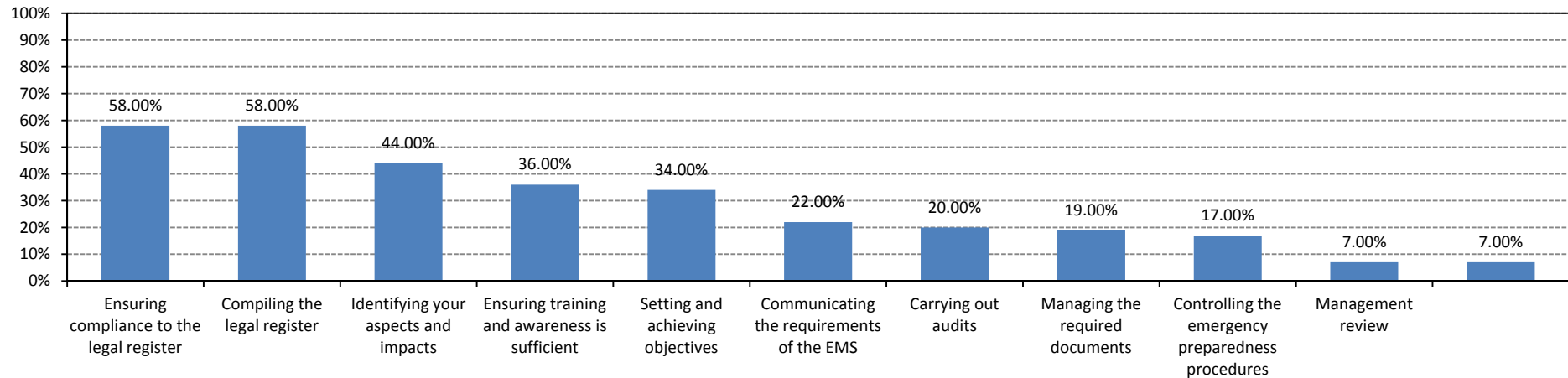


Figure D 17: Question 17: The percentage of people responding “Agree” to the question: The aspects of your EMS you believe actually caused the most problems

D.18 Question 18: The budgeted cost of ISO 14001 implementation was sufficient to achieve certification

D.18.1 Quantitative Data

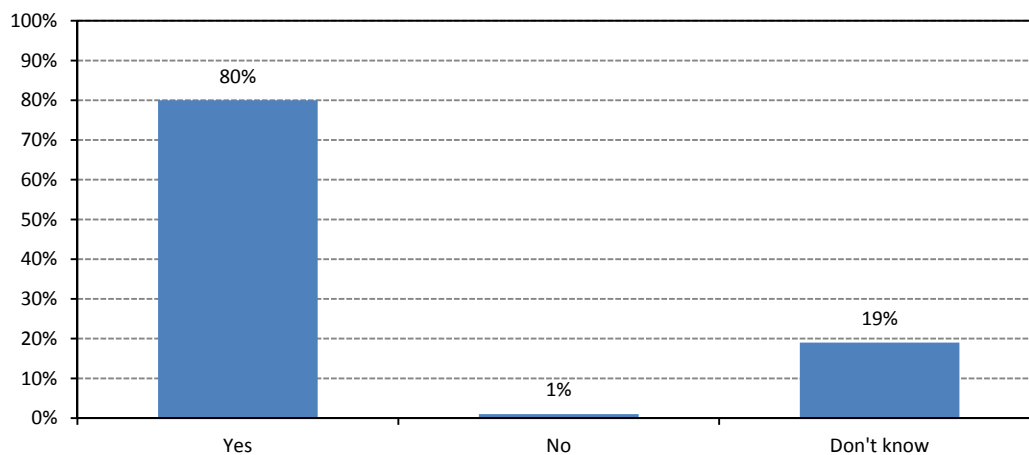


Figure D 18: Question 18: The budgeted cost of ISO 14001 implementation was sufficient to achieve certification

D.19 Question 19: The percentage of people responding “Agree” to the question: ISO 14001 was financially beneficial in terms of:

D.19.1 Quantitative Data

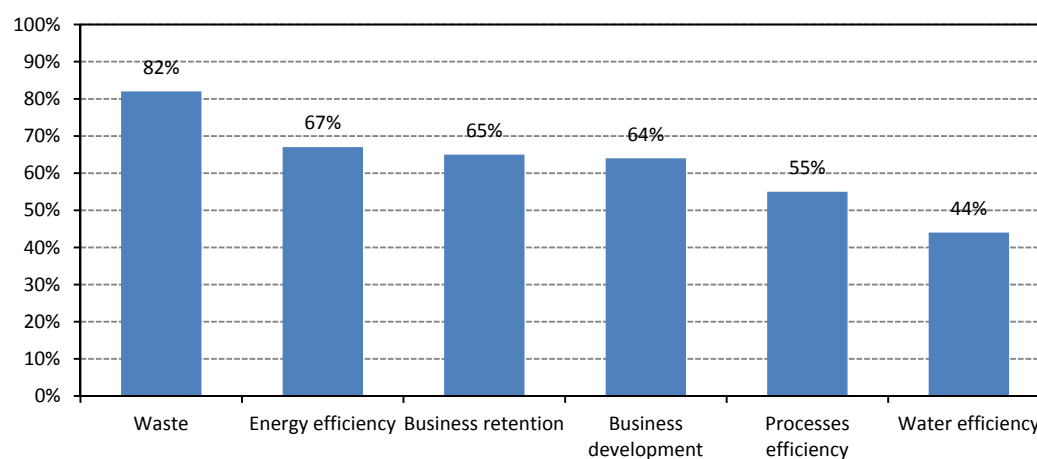


Figure D 19: Question 19: The percentage of people responding “Agree” to the question: ISO 14001 was financially beneficial in terms of:

D.20 Question 20: Do you feel the performance of your EMS has improved other aspects of performance in relation to:

D.20.1 Quantitative Data

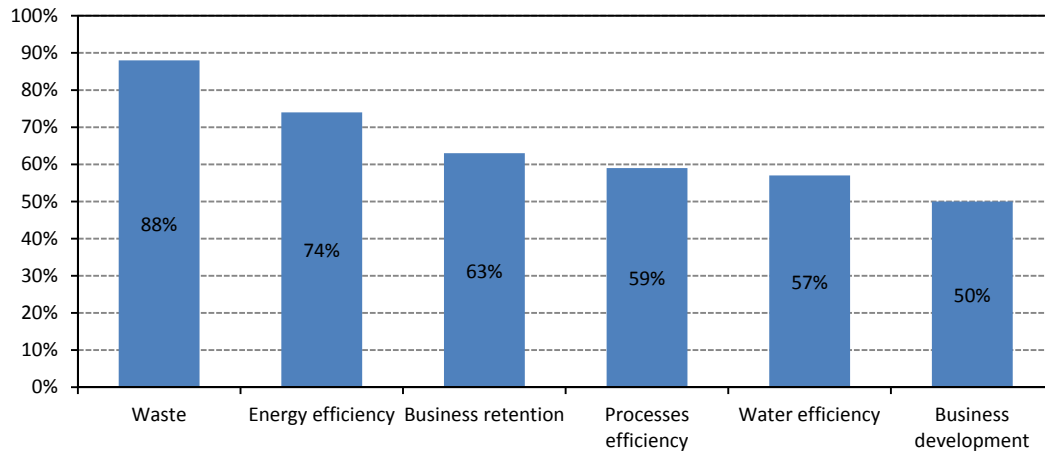


Figure D 20: Question 20: Do you feel the performance of your EMS has improved other aspects of performance in relation to:

D.21 Question 21: Initially our organisation was lacking the required skills to implement ISO 14001

D.21.1 Quantitative Data

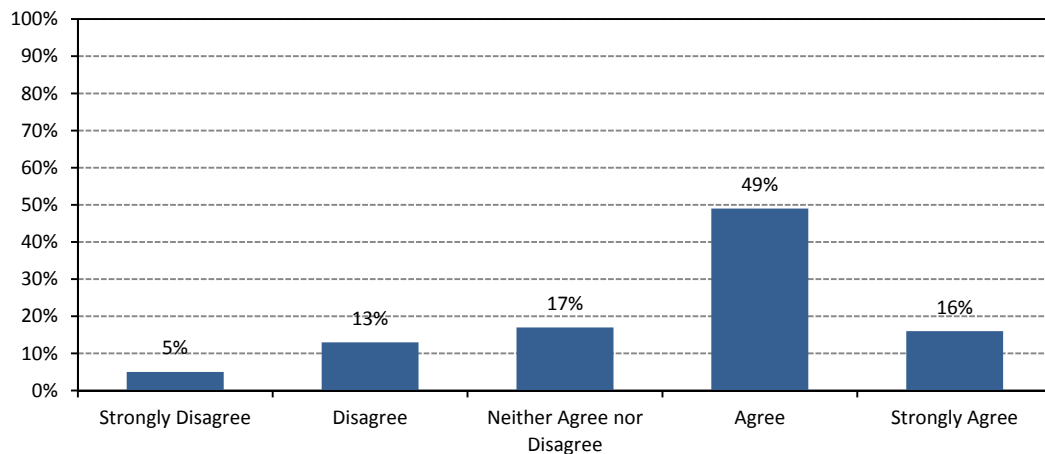


Figure D 21: Question 21: Initially our organisation was lacking the required skills to implement ISO 14001

D.21.2 Qualitative Data

- 21.1 ORGANISATION completely lacked any credible systems prior to the implementation of our IMS and ISO systems.
- 21.2 I had implemented ISO 14001 in previous organisations and had the support of TT2 management and staff so implementation was easy.
- 21.3 Sadly this hasn't improved much especially amongst senior management and the Facilities team. There is an unspoken hostility or at best apathy to the EMS it is seen purely as a necessary evil to tender for public sector projects. There is little recognition that there is a potential for positive benefits.
- 21.4 Initially business did not appoint enough resources and again the Senior Management did not take responsibility. It was only when the certificate became at risk at the first year audit that additional skills and resources were acquired.
- 21.5 External Consultancy was vital
- 21.6 When the business agreed to go for certification to 14k, appropriate training was identified and received for the Environmental Representative.
- 21.7 A person with the required skills had to be employed to implement ISO 14001
- 21.8 We needed outside help to steer us through the process
- 21.9 We had the technical skills and knowledge we required guidance and help integrating 14001 with the 9001 standard that we held
- 21.10 Training of key personnel was required before entering into the process

D.22 Questions 22 to 27: Where were experience and available skill sets beneficial during particular stages of ISO 14001 certification? (Please select as many or as few options as you wish):

D.22.1 Quantitative Data

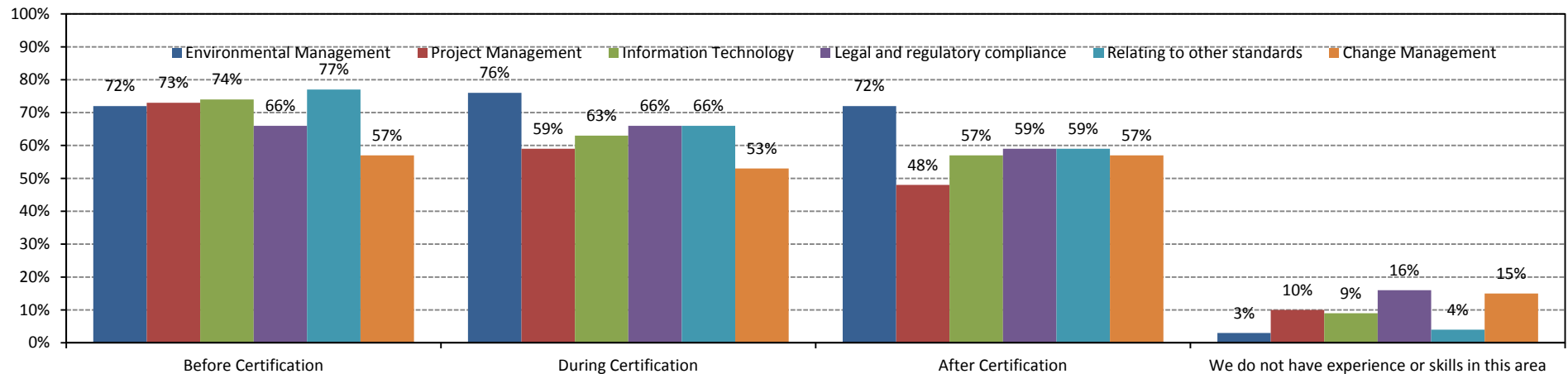


Figure D 22: Questions 22 to 27: Where were experience and available skill sets beneficial during particular stages of ISO 14001 certification? (Please select as many or as few options as you wish):

D.28 Question 28: What key lessons/skills have you learnt through ISO 14001 Implementation?

D.28.1 Qualitative Data

- 28.1 The need to maintain standards, audit and update, the value of ISO based systems in staff and organisational development and the importance of management review and change.
- 28.2 The further you go the more the improvement goals become difficult as the system only requires managing as opposed to improving. Improvement objectives have to be thought of "outside of the box" - no more quick wins.
- 28.3 Be more structured, systematic, organised, more knowledge in environmental matters
- 28.4 That there is still a long way to go for many professional staff in understanding the benefits of the EMS. There is currently no link in senior management thinking regarding identifying and reducing risk or ensuring resilience and sustainability in a resource constrained and unpredictable future
- 28.5 Don't rush these changes and allow take up time for organisation
- 28.6 That you cannot have a successful and beneficial 14001 without adequate resources and commitment from a key appointed individual
- 28.7 Got to get the senior management on board first
- 28.8 The importance of communication
- 28.9 HARD WORK, DETERMINATION, ENVIRONMENTAL AWARENESS
- 28.10 Top management need to see it as integral to the business, not just as an add-on. It must be run by a senior member of staff to ensure non-conformances picked up and fixed.
- 28.11 Better ways of controlling/reducing environmental impacts. Better awareness of legal and other requirements.
- 28.12 Compliance to legislation through internal auditing
- 28.13 Important to engage all employees as soon as possible & throughout implementation
- 28.14 improvement targets can benefit both environmental reductions & cost savings
- 28.15 It can be difficult to understand what Legislation and Regulations are applicable to your organisation. The same can be said for Aspects and Impacts. This is where experience from external consultants can be most beneficial
- 28.16 Best when integrated with other work practices. The danger of it being a stand-alone system is that it doesn't get the priority it deserves. Safety and Financial aspects will be prioritised.

- 28.17 Control and identification of waste streams
- 28.18 Helped with legislative compliance and contractor controls.
- 28.19 Much is open to interpretation and defining an approach that makes sense to your organisation is the critical point. Integration is also key but there are a lot of challenges in achieving a truly embedded system.
- 28.20 Resource intensive.
- 28.21 COMPLIANCE WITH STANDARDS AND SETTING UP MANAGEMENT SYSTEMS AND PROCESSES TO ENSURE COMPLIANCE
- 28.22 Energy monitoring and efficiency Legislation compliance
- 28.23 The need to ensure any communications to staff were unambiguous and fully understood
- 28.24 That it is not as expensive an exercise as previously thought, there is actually money to be saved. Organisation-wide acceptance and improvements. Staff morale and motivation through training.
- 28.25 A basic understanding of legal requirements
- 28.26 No key lessons
- 28.27 control of waste
- 28.28 Challenges
- 28.29 NONE
- 28.30 Integrate it with existing standards ie policies and procedures. External advice and support is useful in helping understand the procedure but should not dictate or force procedures that are alien to the way that we work
- 28.31 how to link aspects & impacts to objectives & targets. how important it is to communicate both internally & externally
- 28.32 Application of legislation to our business
- 28.33 Not many really. Out of all the std's we have 14001 is by far, the easiest to manage.
- 28.34 Energy Reduction Environmental awareness
- 28.35 Involving the workforce in all aspects of the implementation and running of the standards is of significant importance.
- 28.36 The importance of the environment around us
- 28.37 management of environmental impacts
- 28.38 The formal management of related procedures and management of records
- 28.39 Integrate with other standards wherever possible and focus on the areas that could

- hurt the business the most i.e financially and legal compliance
- 28.40 Regular daily monitoring of policy and procedures ensures constant improvement and compliance.
 - 28.41 Compliance with regulatory requirements.
 - 28.42 How to break a standard down to identify specific requirements / actions which are relevant to our business and how to implement necessary processes.
 - 28.43 Keep it simple
 - 28.44 NONE
 - 28.45 We have developed some specifically scientific skills which have been useful to the organisation.
 - 28.46 Environmental auditing & knowledge of environmental systems
 - 28.47 Despite wider awareness of environmental concerns, adoption of EMS policies are slow to implement fully.
 - 28.48 We have learn't how to improve & better manage our impact on the environment.How to reduce the cost of waste disposal & finite resources.
 - 28.49 Legal and Regulatory plus EM Programs
 - 28.50 Environmental management and auditing
 - 28.51 planning

D.29 Question 29: Relevant training and information has been provided to all employees in the form of:

D.29.1 Quantitative Data

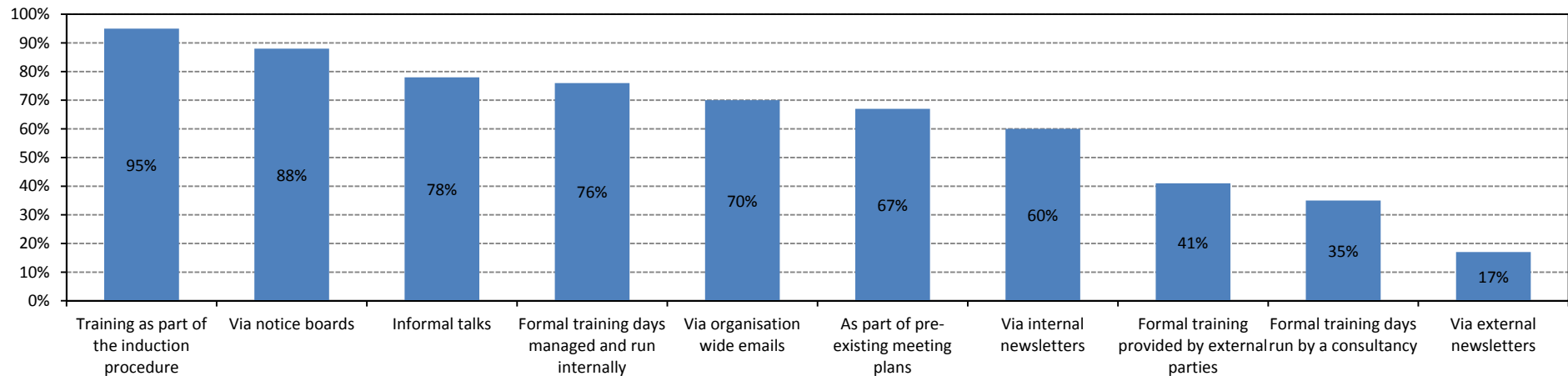


Figure D 29: Question 29: Relevant training and information has been provided to all employees in the form of:

D.30 Question 30: Our organisation actively encourages open discussions and communication within and across different departments

D.30.1 Quantitative Data

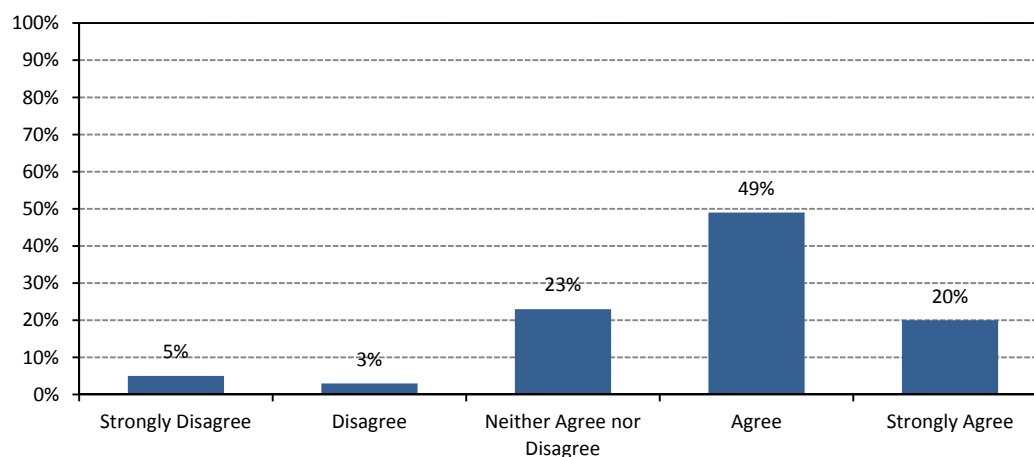


Figure D 30: Question 30: Our organisation actively encourages open discussions and communication within and across different departments

D.30.2 Qualitative Data

- 30.1 We encourage input from all levels to ensure we gain a balanced view of what is happening at an operational level and keep staff informed of what is developing at a strategic level
- 30.2 Initially we had monthly EMS meetings, these are now quarterly. Staff receive an e-mail asking for comments, recommendations for improvement etc before each meeting.
- 30.3 Informal Meetings
- 30.4 Bi monthly meetings
- 30.5 Have only just started something like this. However, best practice elements of environmental performance is being restricted in its communication due to issues with personal relationships with Senior Management
- 30.6 Meetings, conference calls, e-mails
- 30.7 Team meetings
- 30.8 Monthly departmental meetings are held across the business and representatives for different departments attend these meetings. In addition there are suggestion boxes on some sites without internet access. Where there is intranet access, there is an Environmental Suggestions area, where all questions are responded to and answers published for all to see.

- 30.9 Green team meeting monthly with member from each department.
- 30.10 Mechanisms through an integrated management system and Management leading by example
- 30.11 Quarterly briefings and Q&A with CEO
- 30.12 Discussion is encouraged through daily meetings, toolbox talks and weekly team briefs
- 30.13 We run an internal university (MM Uni). All staff speak about 'what they do and how'. Where ISO is concerned, this takes shape in the form of not only these uni session but as standard 'new starter' inductions and and ongoing training as and when required.
- 30.14 Various forums and meetings
- 30.15 Interdepartmental Meetings Staff Focus Groups
- 30.16 the 14001 team is made up of representatives of all sections within the org
- 30.17 cross departmental workshops
- 30.18 TELEPHONE CONVERSATIONS
- 30.19 Use of intranet emails and green focus group
- 30.20 Daily meeting where all departments can discuse problems.
- 30.21 Within an Envoronmental committee
- 30.22 team and inter departmental meetings
- 30.23 Open plan office. Discussions commonplace
- 30.24 Small organisation, so issues brought directly to Management at outset. Also regular Management Review Meetigs held with all senior managers ensures regular communication.
- 30.25 We have an open book policy with our workforce.
- 30.26 Meetings regularly held include monthly Directors meetings, quarterly Directors & Associates meetings, weekly team meetings, annual full staff forums.
- 30.27 Mainly in meetings between staff and management.
- 30.28 Through the monthly management team meetings.
- 30.29 At daily meetings
- 30.30 Group Meetings, interdepartmaneltam management and group leaders meetings

D.31 Question 31: When the EMS was implemented all employees were consulted

D.31.1 Quantitative Data

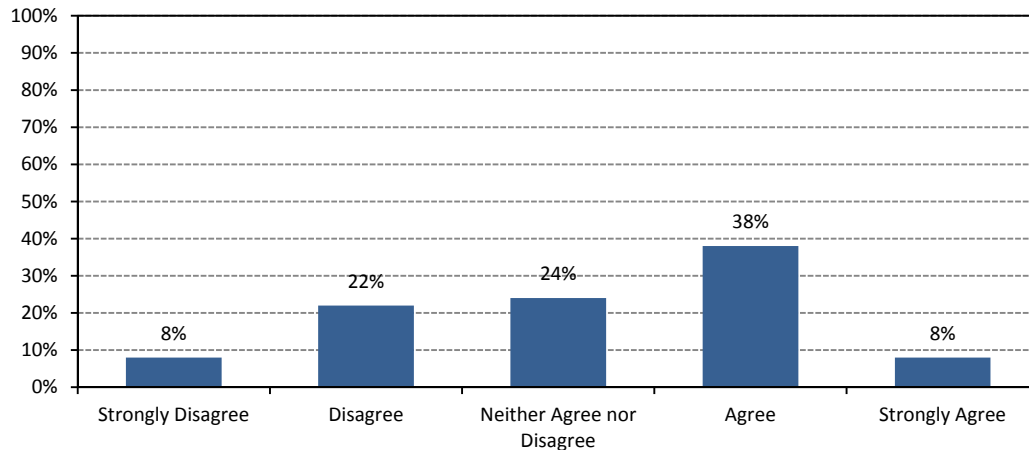


Figure D 31: Question 31: When the EMS was implemented all employees were consulted

D.31.2 Qualitative Data

- 31.1 There was limited scope for consultation as the organisation was in crisis and certain levels of consultation would not have been beneficial at the time we began implementing our IMS/ISO strategy.
- 31.2 Not realistic otherwise we would never have achieved certification - too many cooks spoil the broth!! We had a designated team to implement the system. Before implementation all staff were advised of the EMS and awareness given.
- 31.3 Board only
- 31.4 There is a committee but the effectiveness of the employees has to be measured
- 31.5 Employee awareness through communication meetings
- 31.6 Management tiers only
- 31.7 Some consultation during training, but mainly one-way
- 31.8 All employees were informed openly, not consulted ('consulted' suggests management required staff agreement before implementing?)
- 31.9 The move to implementing an EMS was communicated to all staff via e-mail
- 31.10 only a select number were consulted
- 31.11 All employees were trained.
- 31.12 Yes, it's critical for the EMS to work properly having input from all associates in all

different aspects in the facility operations

- 31.13 Although there was no consultation initially, all employees were consulted during objective setting for the next 3 years

D.32 Question 32: Communication is seen by the organisation as fundamental to the success of the EMS

D.32.1 Quantitative Data

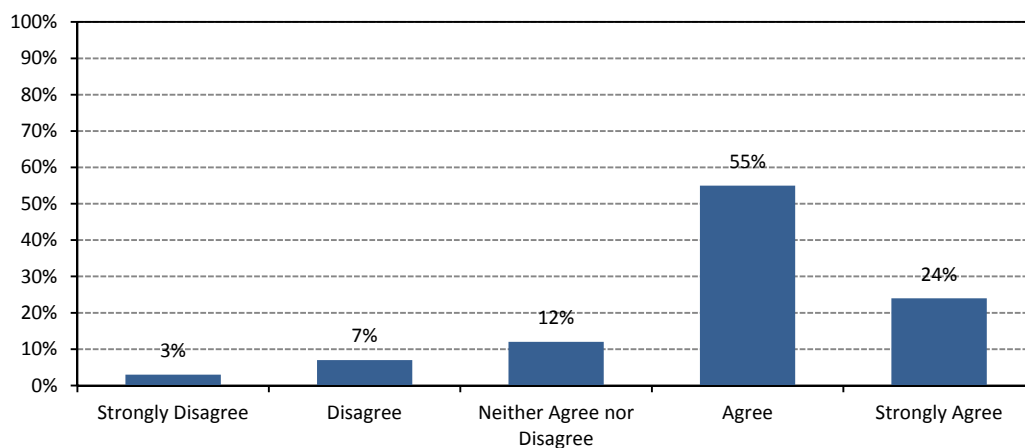


Figure D 32: Question 32: Communication is seen by the organisation as fundamental to the success of the EMS

D.32.2 Qualitative Data

- 32.1 No by the organisation but definitely by the internal sustainability team who drive this communication
- 32.2 Employee awareness through communication meetings
- 32.3 Agreed in Management Review
- 32.4 Ensuring effective communication is fundamental in ensuring continuous improvement
- 32.5 We try to be totally transparent with staff and encourage ideas / thoughts.
- 32.6 Environmental objectives are reviewed regularly.
- 32.7 Meetings, emails, alerts are important activities that maintain the EMS up-to-date

D.33 Question 33: Our organisation partakes and actively encourages employees to participate in charitable, environmental and/or social activities

D.33.1 Quantitative Data

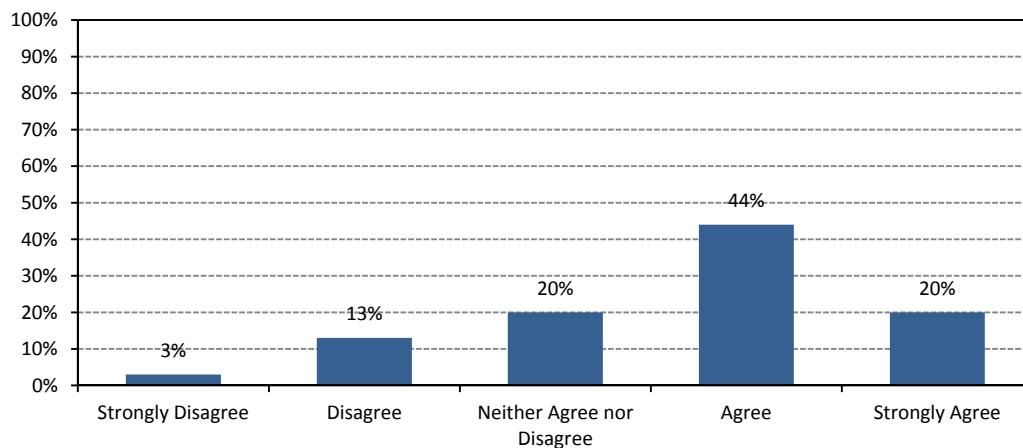


Figure D 33: Question 33: Our organisation partakes and actively encourages employees to participate in charitable, environmental and/or social activities

D.33.2 Qualitative Data

- 33.1 Yes but only on events that a Senior Board Member feels are appropriate events
- 33.2 G24 has strong interaction with local community and has set up an on-site Learning Centre for use by local schools
- 33.3 We have joined the Woodland Trust and have trees being planted in Hertfordshire to total our current carbon footprint of 75 tones CO2. Staff will also be attending tree planting (or some such thing) during 2012 to assist with this objective too and hopefully, we can make this a great marketing campaign. The idea being that our larger customers could join us doing some good for the environment.
- 33.4 Only on recycling (e.g. ink cartridges to charities).
- 33.5 We have programs in the city and also with the community to help and participate to promote health and other social activities

D.34 Questions 34: Our organisation chose to externally publicise the results of its environmental achievements

D.34.1 Quantitative Data

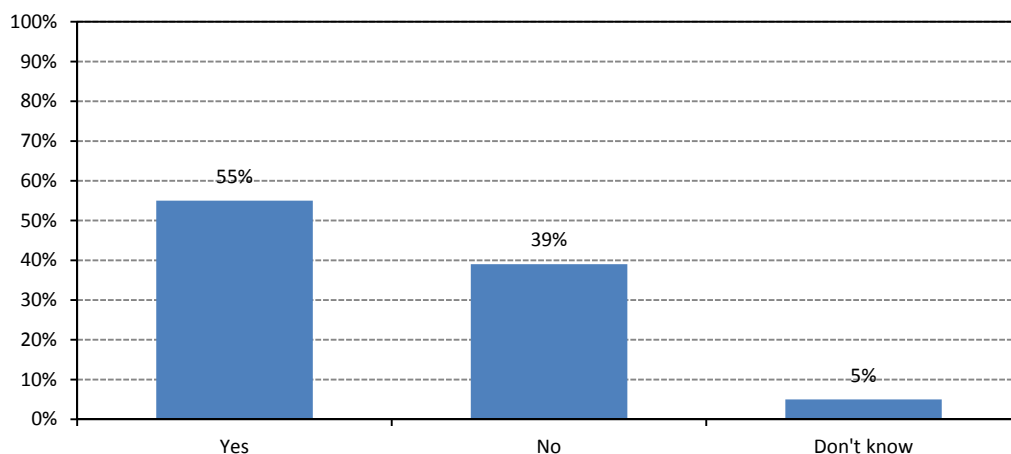


Figure D 34: Questions 34: Our organisation chose to externally publicise the results of its environmental achievements

D.34.2 Qualitative Data

- 34.1 TT2 were, until Nov 2011, registered to EMAS and therefore publicised an externally verified statement.
- 34.2 The fear factor of being caught out and shown at a disadvantage is too strong for there to be any external communication on environmental achievements. This has happened within the last 2-3 years
- 34.3 2011 was first year of publically reporting environmental impacts
- 34.4 Available on request
- 34.5 Via corporate web site
- 34.6 Under review for the future, if customers request it
- 34.7 Through press releases, by attending and exhibiting at exhibitions and entering award schemes
- 34.8 We are still in the early days of our IAPs but as we hit targets worth shouting about, we certainly will be.
- 34.9 certificates are available on our internet site along with our policy statement
- 34.10 on a selective basis only
- 34.11 CSR section included within the Annual Report
- 34.12 Environmental Objectives are published. Also numerous third party case studies

have been published

34.13 Local press release, on Organisation Website and via newsletters and emails.

34.14 To our existing & prospective clients.

34.15 Website

34.16 This is done through our organisation new letter and internet site

34.17 A recent environmental award is posted on our internet site

D.35 Question 35: The percentage of people responding “Agree” to the question: For each sector please state the level of commitment you believe was achieved in relation to your EMS

D.35.1 Quantitative Data

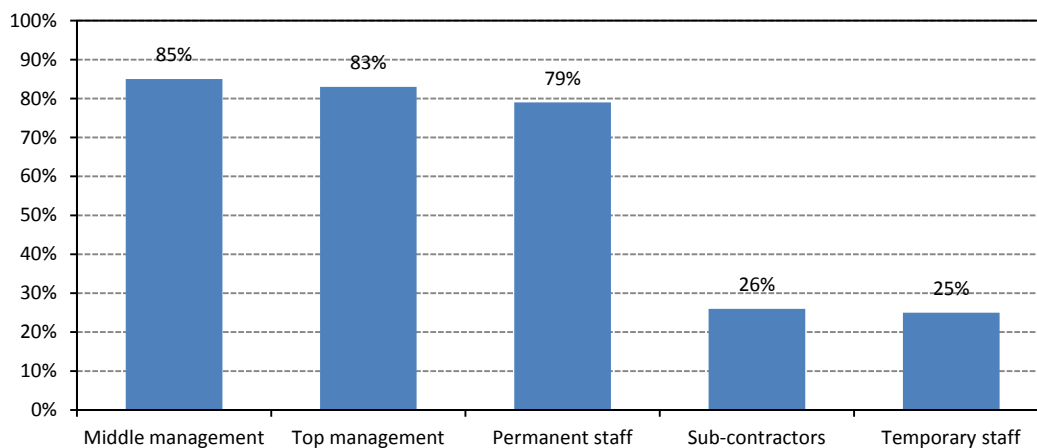


Figure D 35: Question 35: The percentage of people responding “Agree” to the question: For each sector please state the level of commitment you believe was achieved in relation to your EMS

D.36 Question 36: The percentage of people responding “Agree” to: Management review and auditing are important in terms of:

D.36.1 Quantitative Data

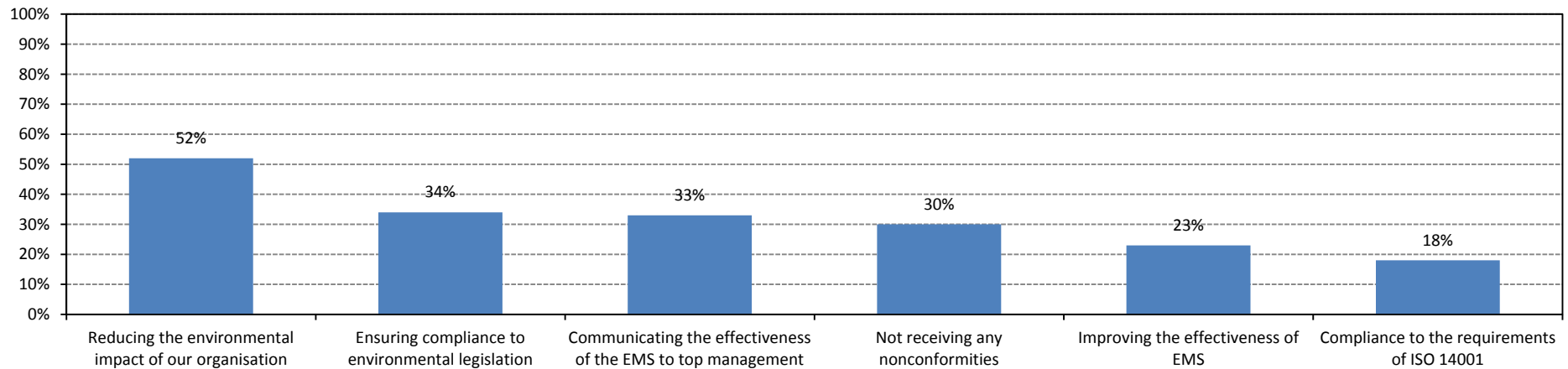


Figure D 36: Question 36: The percentage of people responding “Agree” to: Management review and auditing are important in terms of:

D.37 Question 37: The percentage of people responding “Agree” to the question: Your organisation requires a number of:

D.37.1 Quantitative Data

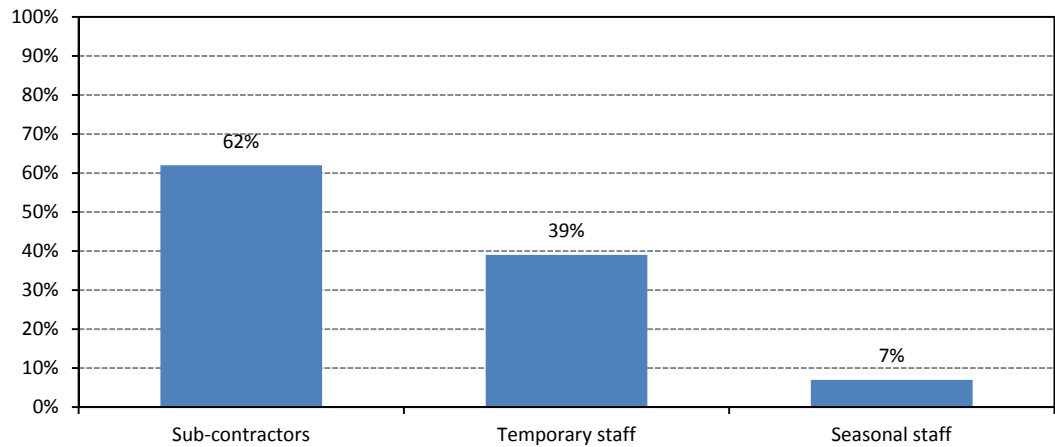


Figure D 37: Question 37: The percentage of people responding “Agree” to the question: Your organisation requires a number of:

D.38 Question 38: Your organisation has a high turnover of permanent staff

D.38.1 Quantitative Data

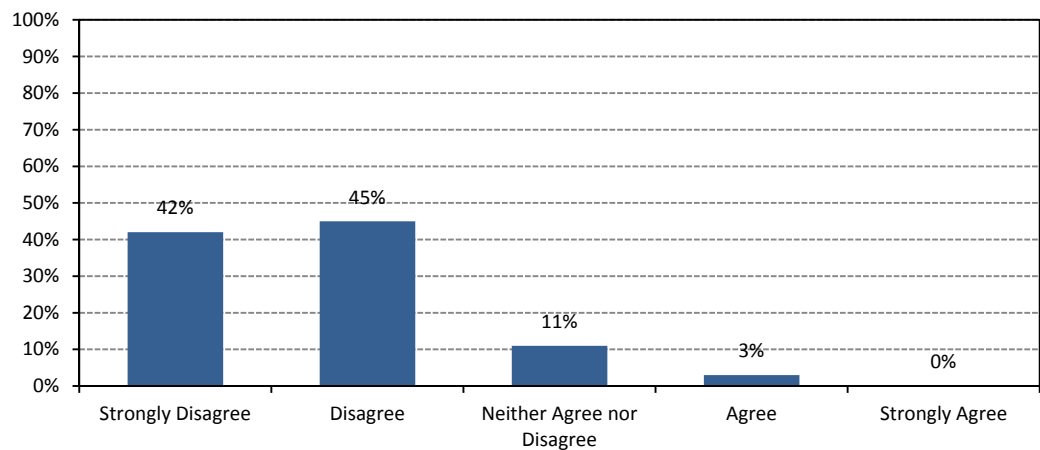


Figure D 38: Question 38: Your organisation has a high turnover of permanent staff

D.38.2 Qualitative Data

- 38.1 Majority of staff are long serving members - some have 30 years service.
- 38.2 The amount of people leaving is not above the industry standard and the amount arriving is large. We have approximately 12 new employees each month in the UK operations alone and we are expanding in most regions globally. The EMS has only been certified in the UK to date but a requirement has been set by the CEO for all regions to become certified within the next year or two.
- 38.3 Less than 3% across the business
- 38.4 The Organisation is relatively young and has a number of staff who have been with it since its inception
- 38.5 Many staff have been with the business over ten years
- 38.6 Extremely high employee retention, average service is 10 years+
- 38.7 Staff turnover is very low for our industry at 11%
- 38.8 Nearly all staff have been in the organisation for 10 years or more
- 38.9 No turn over from our staff. I have been happily working for our organisation for over 23 years today is my anniversary with the company Feb 29 1989

D.39 Question 39: What training has been provided to the Environmental Manager?

D.39.1 Qualitative Data

- 39.1 we do not have a dedicated environmental manager
- 39.2 None required - manager has BSc in Environmental Science and is a Lead auditor in Quality, Environment and H&S. Also has NEBOSH Certificate.
- 39.3 First aid at work, defibrillator course, informal training
- 39.4 Inductions One to One Training
- 39.5 I don't know but I, as the environmental advisor have been given lead auditor training in ISO14001
- 39.6 Awareness training. Membership of GBN.
- 39.7 Lead auditor, ground work NVQ level 4
- 39.8 Attendance at relevant CPD's and seminars. Training for internal auditing under review.
- 39.9 He is trained to lead auditor standard for 14001

- 39.10 Implementing an EMS via Enviros
- 39.11 Introduction to ISO14001 EMS Auditing Environmental Legislation and other relevant
- 39.12 NONE
- 39.13 No formal training
- 39.14 SGS training courses.
- 39.15 None
- 39.16 Internal Auditing
- 39.17 EMS Awareness & support by consultants when implementing ISO14001 - Also EMS Auditing.
- 39.18 compliance to permit holders duties
- 39.19 Lead Auditor conversion course Waste Management and Law Seminars & Conferences ie Sustainable Business and Energy Solutions Carbon Trust events and awareness sessions
- 39.20 Trained as an Internal Auditor
- 39.21 IEMA Associateship training
- 39.22 Internal auditor training
- 39.23 Lead auditor training
- 39.24 Auditor training, awareness training on other management standards
- 39.25 One to one from external consultant
- 39.26 The Environmental Manager attended associate membership training, environmental auditor training and sustainable procurement training as well as a number of workshops and conferences. He is now a full member of IEMA.
- 39.27 IEMA certification and SGS auditing
- 39.28 NEBOSH GENERAL CERTIFICATE IN OCCUPATIONAL SAFETY AND HEALTH
- 39.29 External Training by BSI
- 39.30 The Environmental Manager is relatively new and joined the Organisation with numerous qualifications and experience. Any training needs will be would be progressed through HR
- 39.31 Nothing
- 39.32 Official training: None

- 39.33 External training
- 39.34 Various courses and updates (BIS and NIEA)
- 39.35 Was previously responsible for EMS within large private sector org.
- 39.36 5 day SMSTS traing and CSCS skills training
- 39.37 Don't know, no formal training just under advice of consultant
- 39.38 EXTERNAL AUDITING COURSE
- 39.39 Environmental maager has recieved training from our external consultant. She is also a qualified BREEAM assessor and has an environmental degree
- 39.40 IEMA qualified
- 39.41 ISO14001 Lead Auditor
- 39.42 None
- 39.43 External Consultant Support In addition to being training to Lead assessor std by BSI
- 39.44 Environmental Legislation EMS and ISO14001 Environmental Auditing Seminars,conferences,Local Business Groups
- 39.45 Internal Auditor BSI training
- 39.46 Auditing Course Environmental Management Course.
- 39.47 EMS management training
- 39.48 Previously third party auditor
- 39.49 Internal Auditing
- 39.50 SGS ISO14001 lead auditor training, degree in environmental chemistry, aspects and impacts training
- 39.51 Lead Auditor Training, Associate Certificate in Environmental Management (AIEMA) plus various other waste management, legislation and energy courses
- 39.52 Completion of relevant in house training in EMS Management and external specialised training in Audit Management.
- 39.53 consultancy used for environmental service,
- 39.54 The QHSE Manager holds the NEBOSH General Certificate in Occupational Safety & Health. Also various internet modules undertaken periodically.
- 39.55 External Consultancy
- 39.56 Overview of ISO14001 to all staff prior to certification. Regular updates to all

staff. Induction information. Formal presentation to all staff annually.

- 39.57 QEMS Manager - internal auditing + achievement of certification to ISO 14001
Training for other manager roles stated below unknown
- 39.58 Attendance at external seminars and CPD.
- 39.59 MSC
- 39.60 external partially funded multi day course
- 39.61 NEBSOH and Environmental Certificate
- 39.62 SGS Internal Auditor Training Cours + Environmental Awareness training by
Wakefield MDC
- 39.63 Single day formal BSI Standard training
- 39.64 Consultant
- 39.65 lead auditor 14001
- 39.66 Outside training and annual training refresh courses
- 39.67 Environmental Management and auditing
- 39.68 IEMA foundation certificate
- 39.69 we DO NOT HAVE AN ENVIRONMENTAL MANAGER JUST EMS COORDINATOR
(ISO14001 AUDITOR)
- 39.70 IEMA memeber, IRCA auditor

D.40 Question 40: What percentage of your time is dedicated to the role of Environmental Manager?

D.40.1 Quantitative Data

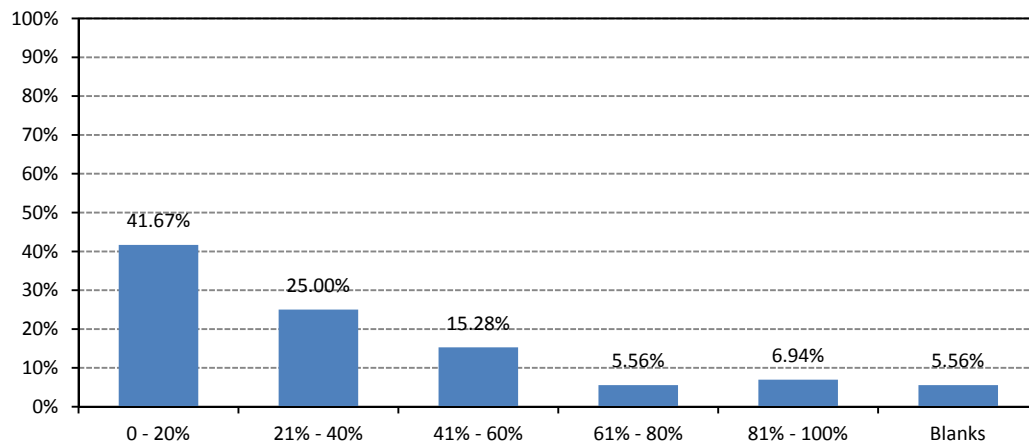


Figure D 40: Question 40: What percentage of your time is dedicated to the role of Environmental Manager?

D.41 Question 41: How many people are involved in your environmental team?

D.41.1 Quantitative Data

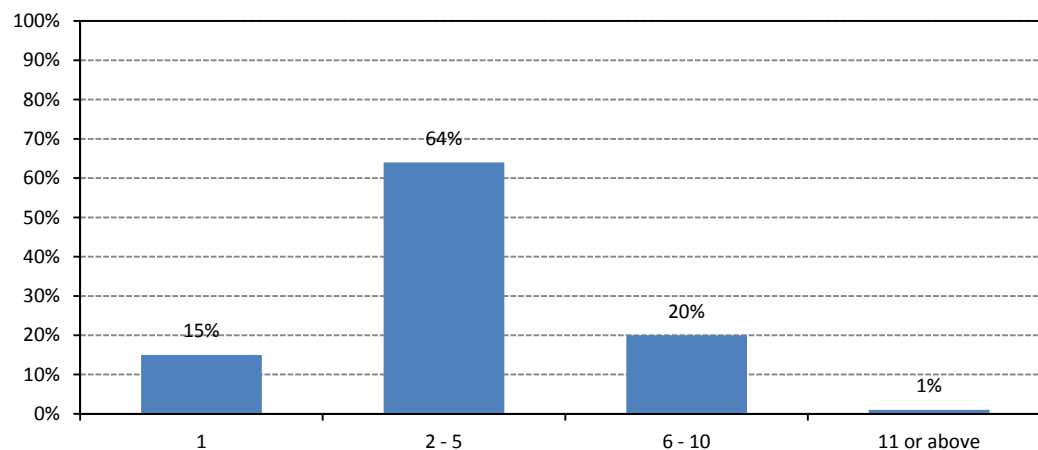


Figure D 41: Question 41: How many people are involved in your environmental team?

D.42 42. What resources have been exploited to improve the effectiveness of the EMS?

D.42.1 Qualitative Data

- 42.1 we have included this role as standard for our core management team ((4 staff)
- 42.2 When resources are required they are acquired by the SQE Manager.
- 42.3 My salary, the salary of the HSQE manager and the costs of auditing although this is divided between the Health and Safety audits which happen concurrently.
- 42.4 Top Management
- 42.5 Time technological financial
- 42.6 N/A
- 42.7 People.
- 42.8 External consultants to provide auditing and reviewing documents
- 42.9 nONE
- 42.10 On-line technical library and professional librarians, existing environmental legal knowledge of staff.
- 42.11 Tecnical skills
- 42.12 Internal and External Audits
- 42.13 Existing quality & Health & Safety procedures
- 42.14 Subscription to Croner's, Net Regs, Health & Safety Practitioner etc.,
- 42.15 External Consultant
- 42.16 Head office environmental team
- 42.17 As our business (waste management) is environmental the knowledge and expertise of our staff, particularly our technical staff.
- 42.18 Networking and best practice sharing.
- 42.19 At all management levels and departments
- 42.20 The Carbon trust Carbon management Service has been used which reulted in a five year carbon management plan being published.
- 42.21 facilities management team

- 42.22 INTERNET INFORMATION
- 42.23 The environmental team Manufacturing Advisory Service
- 42.24 The system is relatively new but any resources deemed necessary will be used as the system matures
- 42.25 Consultancy SGS documentation
- 42.26 Monthly quality & environmental meeting
- 42.27 internal staff primarily
- 42.28 Netregs WRAP Environment Agency website Environmental Consultancy organisation
- 42.29 Use of our BREEAM team and the Architects within our organisation who have strong environmental credentials. We are also using one planet living to set standards for our direct aspects and environmental design standards such as BREEAM code for sustainable homes etc to set our indirect aspects
- 42.30 TITAN QMS software package
- 42.31 Other members of team seconded to support rollout as & when it occurs
- 42.32 Time Effort Money
- 42.33 Myself and support from colleagues
- 42.34 Induction training. Team Meetings. Kaizen Events Improvement activities.
- 42.35 Personnel and financial
- 42.36 Sustainable Development project
- 42.37 BREEAM and BRE, University Library, Croner Environmental Management
- 42.38 Various consultancy and improvement projects mainly from the Carbon Trust. Government run seminars from Arena Network etc. Company wide environmental and energy training
- 42.39 SGS, IMS Consultancy, NetRegs, and other external links to both Quality & Environmental Management data.
- 42.40 sufficient to operate the system and comply with our legal obligations.
- 42.41 Time
- 42.42 Internal staff. External Consultant. External Training Courses.
- 42.43 SGS external surveillance visits
- 42.44 NONE

- 42.45 Good ideas
- 42.46 Suppliers, internal managers
- 42.47 Warehouse and assembly staff as well as utilising IT reporting software to track and monitor environmental aspects.
- 42.48 Help from waste contractors.
- 42.49 Having assistance by outside contractor Sassan Moradian to review and comment on the status of our system
- 42.50 IT, HR, Green Team
- 42.51 QHSE appointment